State of Vermont

Department of Fish and Wildlife
Department of Forests, Parks and Recreation
Department of Environmental Conservation

AGENCY OF NATURAL RESOURCES
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Waterbury, Vermont 05671-0601

DEPT. OF FORESTS, PARKS AND RECREATION

Fax: (802) 244-1481

June, 2001

Dear Vermont Forester:

Enclosed is the *"2000 Vermont Forest Insect & Disease Conditions Report."* This report is provided to all foresters practicing in Vermont to assist them in management decisions. Produced by the Forest Resource Protection section, Division of Forestry, it provides data on 2000 pest problems and recommendations for managing forest and pest interactions.

This report contains maps showing the general location of major pest problems detected in 2000. We have detailed survey maps showing more specific location of reported damage available in our field offices if you care to look at them. All detected and mapped damage sites are now scanned into a state GIS system. This information is provided for your use in developing forest management plans or carrying out silviculture operations.

In the back of the I&D Conditions Report are separate short reports, *"Health of Sugar Maple in Vermont, 2000," "Common Pests of Christmas Trees in Vermont, 2000,"* and an interesting report from the Forest Biology Laboratory.

Information on the Asian long-horned beetle problem in the Brooklyn, New York area and in the Chicago area is still available from my office or from Margaret Skinner/Bruce Parker, Entomology Research Lab, PO Box 53400, Burlington, Vermont 05405-3400. Vermont is involved in an Asian long-horned beetle public awareness program. Additional copies of ALB material is available free of charge. ALB has not been found in Vermont!

Again this year we are informing the public of the increasing threat from the *Hemlock Woolly Adelgid.* Infected hemlock nursery stock continue to be found in Maine and New Hampshire but not in Vermont. Additional copies of HWA material is available free of charge from my office or from the Entomology Lab at the address given above.

We gratefully acknowledge the financial and technical support provided by the USDA Forest Service, Northeastern Area State and Private Forestry that enables us to conduct the surveys and publish the results in these reports.

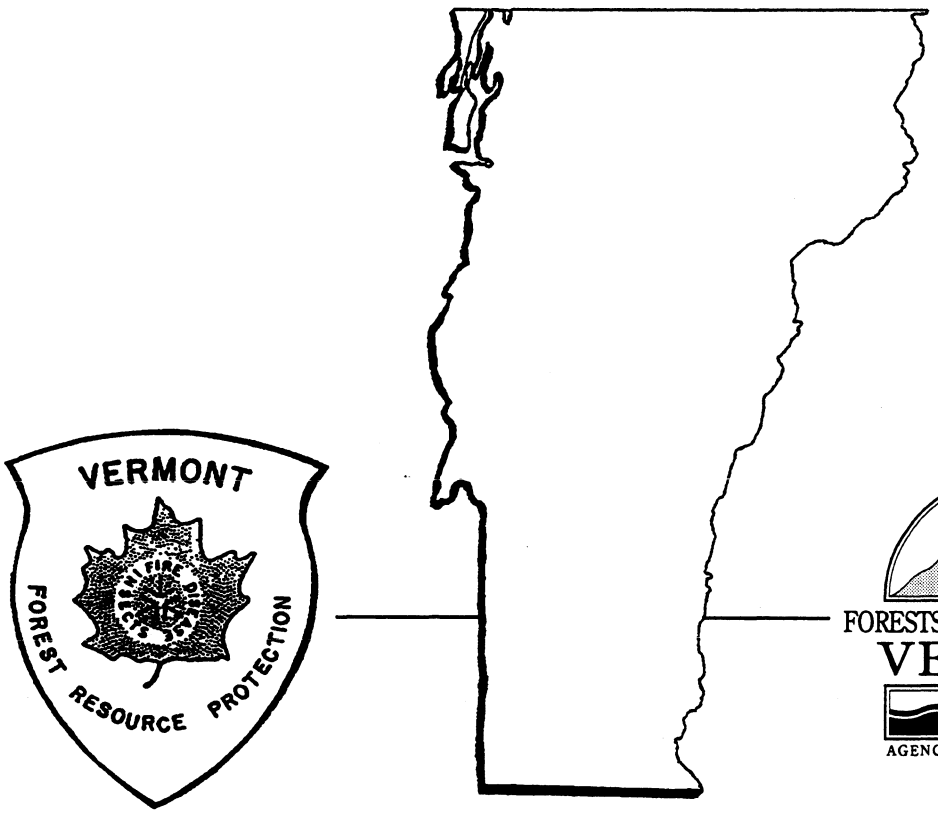
Sincerely,

Brent

H. Brenton Teillon, Chief
Forest Resource Protection

P.S. Additional copies of these publications are available upon request, or you may copy any portion of this material.

FOREST INSECT AND DISEASE CONDITIONS IN VERMONT 2000



AGENCY OF NATURAL RESOURCES
DEPARTMENT OF FORESTS, PARKS & RECREATION
WATERBURY, VERMONT 05671-0601

FOREST INSECT AND DISEASE CONDITIONS IN VERMONT

CALENDAR YEAR 2000

Balsam Shootboring Sawfly Laying Eggs

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We gratefully acknowledge the financial and technical support provided by the USDA Forest Service, Northeastern Area State & Private Forestry that enables us to conduct the surveys and publish the results in this report.

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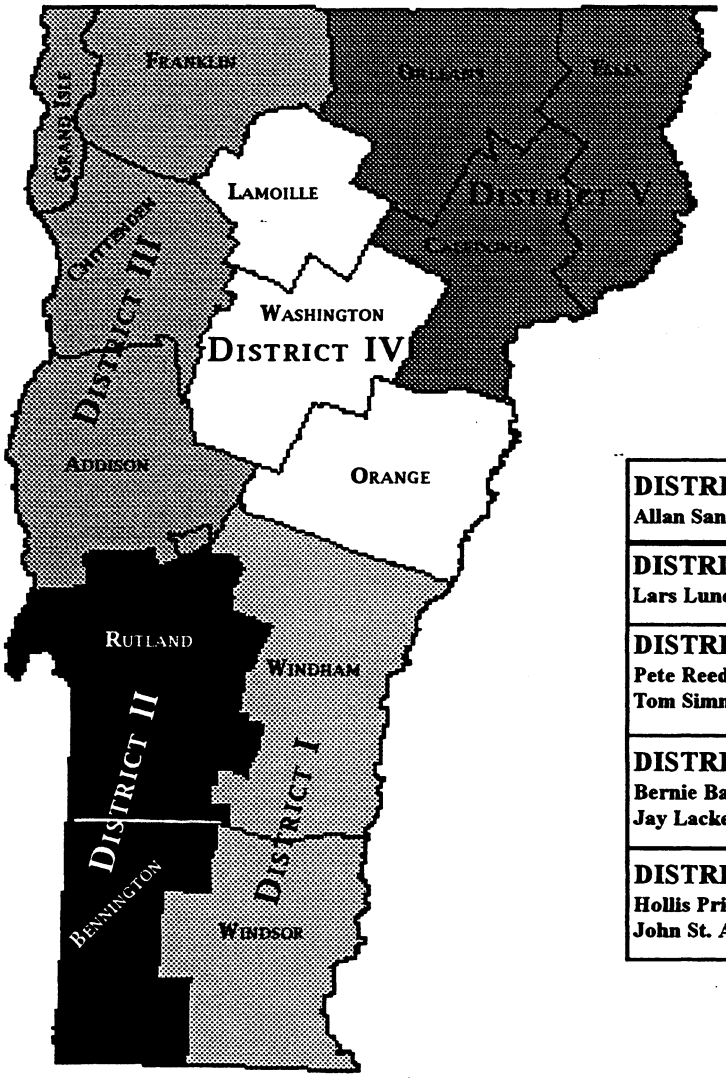

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2000 Vermont Forest Insect and Disease Highlights

Anthracnose damage was widespread in 2000 due to the wet spring and persistent humid conditions, with many species of hardwoods affected. In all, 73,095 acres with brown foliage were mapped.

Apple Scab was widespread, beginning early in the season. Severe damage occurred to the leaves and fruit of wild apples, ornamental crabapples, and fruit trees which had not been protected with fungicide.

Balsam Gall Midge remained at elevated population levels this year with heavy damage to wild forest trees and regeneration, as well as widespread damage to Christmas trees. Damage should be lighter in 2001.

Balsam Shootboring Sawfly damage was much more common than in 1999 but at mostly light levels for the Christmas tree plantations surveyed.

Balsam Twig Aphid populations decreased with mostly scattered, light damage throughout the state.

Beech Bark Disease chlorosis was less conspicuous than normal due to ample moisture availability. The amount of beech scale increased, in monitoring plots, from 1999.

Birch Defoliation, caused by Birch Leaf Miners, appeared to be common but at lower levels than in 1999. Birch with brown leaves was mapped on 30,569 acres during aerial surveys. Damage was predominantly caused by fungus diseases.

Butternut Canker continues to cause widespread dieback and mortality of butternut. Research continues at the University of Vermont Forest Pathology Laboratory on the disease vectoring ability of insects associated with butternut.

Drought symptoms, incited by water stress during the growing season of 1999, were observed on a variety of species. Decline symptoms were common on disturbed or limiting sites, on recent transplants, and on wounded trees.

Environmental Stress, including its impact on calcium, genetics, and sustainability, is the focus of research by scientists from the US Forest Service Northeastern Research Station and the University of Vermont School of Natural Resources.

Forest Tent Caterpillar populations continued to be very low this year and no forest defoliation was observed.

Gypsy Moth populations increased this year, but caused no significant defoliation. Wet spring weather is thought to have led to a build-up of *Entomophaga*. Although no widespread defoliation is expected in 2001, localized heavy defoliation is likely in a small forested area in Colchester.

Hardwood Decline and Mortality symptoms were mapped on 15,180 acres, compared to 21,223 acres mapped during the dry growing season of 1999.

Heavy Seed production on many species led to thin crowns statewide, particularly on white pine and red maple.

Hemlock Decline was widely observed in late winter and early spring. Symptoms were most common on ledgey, poorly drained, roadside, and disturbed sites.

Ice Storm Damage from the January 1998 storm continues to be visible. Although there was additional mortality, mostly of paper birch, many broken trees are continuing to recover.

Invasive Exotic Plants continue to threaten successful forest regeneration. Over 1% of seedlings, saplings, and shrubs in the 1997 FIA survey were from genera which include invasive exotics. A noxious weed quarantine has been drafted to restrict the sale or import of 33 plant species.

Large Aspen Tortrix was thought to be responsible for moderate-heavy damage to quaking aspen in the lower Connecticut and White River Valleys. Moths were numerous in northern Vermont, and light feeding was also observed in Essex County.

Locust Leaf Miner caused heavy foliage browning to black locust in Putney and the Champlain Valley. Locust mortality continues in Hartland, caused by previous leaf miner defoliation.

Maple Leaf Cutter increased, with damage occurring statewide. The most widespread damage to overstory trees was observed in Windsor and Orange Counties. The 73,095 acres of hardwood browning mapped during aerial surveys was a combination of maple leaf cutter, anthracnose, and maple trumpet skeletonizer. In 1999, 14,479 acres of damage were attributed to maple leaf cutter.

Maple Trumpet Skeletonizer was commonly observed on sugar maple. The heaviest damage was observed in the Northeast Kingdom and Windsor, Orange, and Washington Counties.

Oystershell Scale populations on American beech were light in most locations, however, levels in the survey plot in Huntington jumped to the highest in five years.

Pear Thrips populations were down from 1999 and little damage was observed. Forced emergence counts in soil samples collected in the fall of 2000 show an increase in the numbers of thrips in many stands. Damage may be observed in spring 2001 if weather conditions prolong bud development.

Pine Shoot Beetle adults were caught in traps in Caledonia and Orleans Counties, but not Franklin, Lamoille, Chittenden, Washington, or Grand Isle Counties. No pine shoot damage from this insect has been detected.

Rhizosphaera Needlecast was widely scattered on red spruce regeneration in southern Vermont. On ornamentals, needlecast severity on blue, white, and Norway spruce increased statewide.

Saddled Prominent populations remain low with no defoliation of sugar maple detected.

Scleroderris Canker has not been found in any new towns since 1986. Within the quarantine zone, 11 pine Christmas tree plantations which were surveyed were all found free of the disease.

Spruce Budworm continued at low levels, with no visible defoliation detected. However, the number of moths captured in pheromone traps in northern Vermont jumped to the highest level seen since the end of the last outbreak in 1983.

Spruce-Fir Mortality and Dieback was mapped on 3,545 acres this year. Defoliation and dieback of red spruce regeneration were frequently observed in the southeastern Green Mountains in the spring.

Squirrel clipping of conifer shoots to feed on buds was widespread in winter '99-'00.

Striped Alder Sawfly was responsible for 1391 acres of paper birch defoliation in Westmore, Charleston and Brighton.

Sycamore Anthracnose was unusually severe. Complete blighting of the first flush of foliage was often followed by additional damage to refoliation.

Viburnum Leaf Beetle was identified from three locations in the Burlington area by Richard Hoebeke from Cornell University. This is the first record of this pest in Vermont.

Wet Site conditions caused more widespread damage than normal. In all, 10,194 acres were mapped during aerial surveys.

White Pine Blister Rust remains common statewide. Heavy (20-60%) incidence levels were observed in scattered pole-sized stands, while levels observed during the Christmas tree survey were mostly light or moderate.

White Pine Needle Chlorosis developed on white pine in scattered locations by early June. Symptoms were thought to have been incited by the '99 drought.

Vermont 2000 Forest Health Management Recommendations

The following recommendations summarize information in this report of particular importance to forest managers. Additional information can be found under specific pests mentioned. Separate summaries for sugarbush and Christmas tree managers are in the appendix.

For assistance in identifying pests, diagnosing forest health problems, on-site evaluations, and insect population sampling, or to obtain copies of defoliation maps, management recommendations, and additional literature, contact forest resource protection personnel (page 1) or your county forester.

The **General Health** of trees was good in 2000, with ample water availability and low populations of most pests. Where the drought of 1999 had a significant impact on trees, symptoms should already be visible; elsewhere, assume trees are recovering adequately. Most trees damaged by the ice storm of 1998 are also recovering. Substantial regeneration has occurred in the openings in heavily damaged stands. More information about tree response to storm injury can be found at www.fs.fed.us/na/durham/patterns.htm.

Regeneration failures continue to be a concern in southern regions affected by heavy browsing and invasive exotic woody plants. Whether within or outside the generally affected areas, consider the presence or absence of buckthorn, honeysuckle, bittersweet, or other exotic plants when evaluating stands. The new FOREX survey allows users to document the presence of exotic species in the vicinity. Attempts at control may be most effective if directed at new, limited infestations where potential for success is greater than in more established populations.

Exotic insects are also of particular concern. Pine shoot beetle and viburnum leaf beetle have been recently detected in Vermont, and Asian longhorned beetle, hemlock woolly adelgid, brown spruce longhorned beetle, and Japanese cedar longhorned beetle threaten from nearby. Early detection is an important defense against establishment of these insects in Vermont. We rely on foresters and the general public throughout the state to recognize the symptoms and report them promptly.

Maple trees experienced widespread foliage browning late in the season, primarily from anthracnose and maple leaf cutter. The late timing of the damage should limit its impact on tree health. However, maple leaf cutter has been heavy in some stands for several years, and it is expected to be present again in 2001. Disturbance should be avoided in stands with repeated heavy defoliations, particularly on acidic sites.

Other maple defoliators have been at low levels. Pear thrips damage is expected to be more noticeable in 2001, especially if cool wet spring conditions delay bud development and allow anthracnose fungi, now at high levels, to infect damaged leaves. Watch to make sure refoliation occurs if stands are defoliated.

Crown recovery is proceeding in maples damaged by the ice storm. Research by the US Forest Service has found that, after 2 years, discoloration and decay in maple extends from a few inches to less than a foot from the wound along the main stem. Most trees without other pre-existing wounds should be able to successfully compartmentalize ice damage.

Beech bark disease may increase, as beech scale was more noticeable in 2000. Where there are high populations of scale, it is a good time to identify individual trees which are genetically resistant to infestations by this insect. We recommend not cutting these apparently resistant trees.

Birch browning was common again, caused mostly by foliar pathogens and birch leaf mining insects. Since damage peaked late in the growing season, no management adjustments to birch are recommended. Birch continues to be the species most likely to die from the ice damage in 1998, while its wood has more discoloration and decay from ice breakage than other species.

Ash dieback was observed on some sites with fluctuating water availability, like intermittent stream banks and seeps. Since the initiation of the decline is attributed to the drought of 1999, symptoms should already be visible where this condition is likely to occur. Ash on these sites should be evaluated when leaves are present to ensure that decline is not progressing.

Oak pests were generally of minor impact in 2000 in Vermont, although gypsy moth populations did increase somewhat. Defoliation in 2001 is expected only in Colchester. Nationwide, defoliation by gypsy moth increased substantially in 2000, to 1.6 million acres, with a new wave of mortality developing in Pennsylvania. In eastern Massachusetts, oak was defoliated by gypsy moth and cankerworm. High mast production should increase populations of gypsy moth predators, and may keep numbers from building elsewhere. However, be on the lookout for building populations: larvae, chewed leaves, and frass from May into July, and egg masses starting in August.

Some **Spruce and Fir** insects are currently worth consideration.

Yellow headed spruce sawfly was still active in Maine in 2000, and caused some defoliation in a few Vermont locations. This insect is of particular concern on young, open-grown white spruce. Look for the larvae in June and July, especially on new foliage in the upper crown. The larvae have a red-yellow head and a darker striped body.

Balsam gall midge populations are expected to decline, but damage by this insect has left bare tops on balsam fir which is open-grown or at the forest edge. Expect some dieback of defoliated branches.

Fall hemlock looper populations have increased, and are of concern to balsam fir as well as hemlock. Check for this small "inchworm" in the foliage of lower crowns and young trees in June and July.

Brown spruce longhorned beetle, native to Europe and Asia, is apparently killing healthy red spruce in Nova Scotia. Symptoms are extensive pitch on the bark, coarse sawdust, and oblong exit holes less than 1/4 inch in diameter. Additional information about this insect can be found at the following website: www.gov.ns.ca/natr/protection/insects/bslbeetle.pdf.

Scattered dieback of spruce regeneration in the southern Green Mountains is attributed to the impact of the 1999 drought on shallow-rooted red spruce. Carefully inspect the vitality of understory spruce before any operation intended to release regeneration.

Most spruce and balsam fir seeds have already been released from the heavy cone crops of 2000, and most will germinate between May and early July. Expect a good crop of seedlings, especially where some mineral soil had been exposed prior to seed dispersal. Where soil exposure is severe, dessication will occur, and seedling survival will be limited.

White Pine chlorosis was widely scattered in the spring. As trees continue to recover from the drought of 1999, we recommend inspecting pine sawtimber on shallow sites. Research in Maine indicates that poor water availability in 1995 initiated scattered decline and mortality of sawlog-sized white pine. In affected sites, there were limits to rooting, such as a plow pan or bedrock, within a foot of the surface.

Meager production of new foliage in the upper crowns of many white pines in 2000 was associated with a bumper crop of maturing cones. This should have some impact on growth, but eventual full recovery of most trees is expected. White pine seeds from this bumper crop of cones had fallen to the ground by late fall. Expect a good crop of seedlings, especially on moist mineral soil.

Caliciopsis canker symptoms were more noticeable than normal in 2000. This disease was more common probably because bark was water-stressed in 1999. White pine with Caliciopsis canker may have heavy pitching from the smooth-barked portions of the mainstem. Pitching originates between whorls, not from a single whorl or knot, as in blister rust. Trees producing noticeable pitch are expected to recover, and resulting timber defects, if any, are expected to be minor.

Pine shoot beetle has not been observed causing damage to pine in Vermont. However, the insect has been trapped in Caledonia, Essex, and Orleans Counties. Pine material being shipped from these counties will be required to comply with quarantine regulations in the future.

Hemlock woolly adelgid has been introduced to both Maine and New Hampshire. The Maine introductions were on nursery stock, and the insect has apparently not moved into natural stands. Eradication efforts are underway. In New Hampshire, hemlock woolly adelgid was discovered along the seacoast, and the insect has successfully overwintered. This is the first known instance of adelgid overwintering on established trees in northern New England. Its survival may have been favored by the moderate maritime climate.

The Maine and New Hampshire situations underscore the importance of early detection. We have posters, cards, tags, and other handouts available and welcome new outlets for distributing them to increase awareness of this insect among people who may encounter it. Contact any office of the VT Department of Forests, Parks and Recreation for handouts. Although the potential for damage by adelgid is of concern in Vermont, we are not currently recommending changes in hemlock management.

Hemlock decline on limiting sites was initiated by the drought of 1999 or the warm early winter. Many trees were attacked by hemlock borers, and are unlikely to survive. Elliptical exit holes indicate a successful hemlock borer attack. Generally, over half of the roots on these trees are already dead. Neighboring trees which are healthy are unlikely to be attacked. Nonetheless, favor group selection when salvaging declining hemlocks, since removing single trees would put nearby trees at risk.

INTRODUCTION

The information in this report is based largely on aerial surveys to detect forest damage, as well as ground surveys and observations of Vermont Forestry Division staff.

A statewide aerial survey was flown from mid-August to mid-September to target late season defoliators, fungal diseases, and general forest condition.

A survey of Christmas tree plantations is conducted annually in North-Central Vermont as part of the Scleroderris quarantine. This year, 260 acres were surveyed. Observations are made on all pests during this survey. Acreages reported for Christmas tree problems refer to changes in these surveyed plantations, and are not statewide totals.

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Thanks to the many individuals who contributed to this report, including Jay Lackey, Tom Simmons, Hollis Prior, Pete Reed, Bernie Barton, John St. Arnauld, Allan Sands, Lars Lund, Tess Greaves, Judy Rosovsky, Phil Girton, and John Barrows (retired) from our Forest Resource Protection staff. Assistance in conducting aerial detection surveys and ground checks was provided by members of our Forest Management staff including Aaron Hurst, Mike Johnson, Brad Greenough, Ron Wells, Dave Wilcox, Dick Greenwood, and Neil Monteith. Matt Mancini assisted in surveys of Christmas tree plantations. Mary Burnham assisted in data entry, field surveys, and insect sorting and identification. Information on Invasive Exotic Plants was contributed by Bob Popp, from the Vermont Non-game and Natural Heritage Program. Diagnostic assistance and other data were provided by Dale Bergdahl, Shari Halik, Margaret Skinner, Don Tobi, Ross and Joyce Bell, and Ann Hazelrigg from the University of Vermont; Jon Turmel and Scott Pfister from the Vermont Department of Agriculture; Dick Dearborn and Clark Granger from the Maine Forest Service; Richard Cowles and John Ahrens from the Connecticut Agricultural Experiment Station, Jen Bofinger from the NH Division of Forests and Lands, Charlie Burnham from the Massachusetts Division of Forests and Parks, and Phil Wargo and Bob Frank (retired) from the US Forest Service. Assistance in processing map data was provided by Tom Luther and Bill Frament from the US Forest Service, Forest Health Protection and Laura Cadmus and Tom Merrifield from the Vermont Agency of Natural Resources.

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Finally, this document about current forest health, and the diagnostic and survey work required to produce it, would not be possible without support from the State of Vermont and from citizens who find the information useful.

Vermont Forest Health, Insect, and Disease Publications: 2000

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WEATHER AND PHENOLOGY

Weather statistics for 2000 are summarized in Figure 1.

Winter 1999-2000 was much warmer than normal with near normal precipitation. There was little or no snow cover in early winter, and average snow depths later in the season.

November and December were unusually warm. 1999 had the third warmest November and the least snowy December on record at the Burlington weather station. Snow that fell elsewhere frequently melted due to warm temperatures and rainfall. The Champlain Valley received most of its snow over a one-month period between late January and late February. There was a brief period of bitter cold in early January, but very little winter injury of marginally hardy plant species. Late February and early March were warm, with spring development beginning early.

The maple sugaring season began early. Production turned out to be above average for most producers, with a mixture of grades. Sap volumes were generally high, with average to below-average sweetness. The weather was good for sap flow.

March temperature averaged five degrees above normal, but in April, the weather turned cooler and wet. Phenological development stalled at the popple flower stage. Conditions remained mostly cool and wet through the spring. The three-month period of March-May was the second wettest ever at the Burlington weather station and April-June was the 8th wettest April-June on record for all of Vermont (NERCC). Spring growing degree day accumulations are summarized in Figure 2a and phenology observations in Table 1.

Flowering was very heavy on many trees and shrubs, but the cool weather slowed growth and resulted in very poor pollination of apples. Chlorophyll development was delayed on many maples, leaving a reddish cast to hillsides into early June.

Cool and wet conditions continued throughout the summer. Although rainfall was frequent, the amount of precipitation was near normal. There were no periods of extreme heat.

Foliage was generally lush and dark green except where the wet, cool spring weather contributed to the development of leaf fungi. These diseases disfigured leaves of many trees, shrubs and other plants during the growing season.

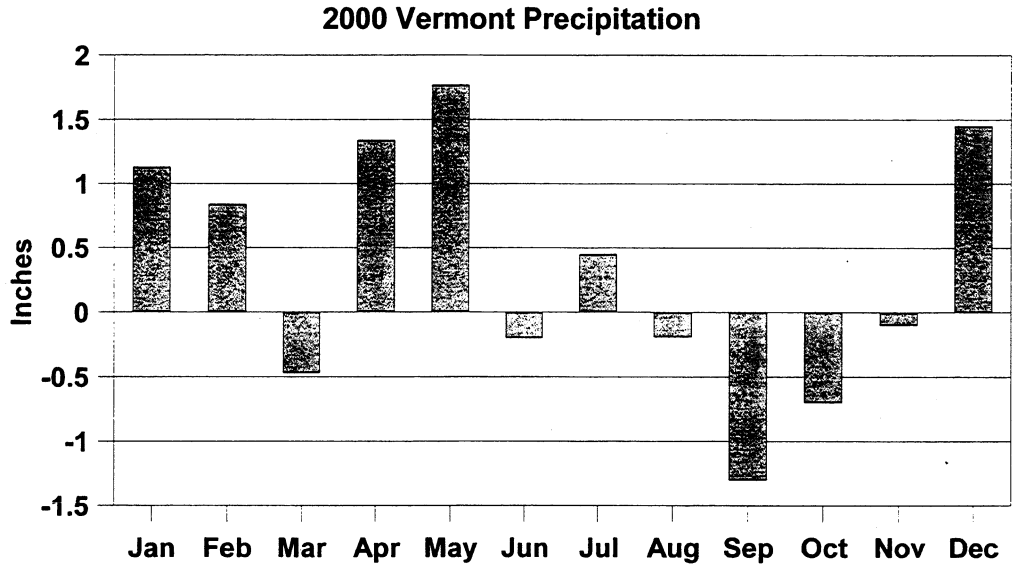
The onset of fall weather was normal or late. The season was generally cooler than normal, with below normal precipitation. An early frost occurred on September 3 for many areas in northern Vermont. A 32° F. temperature in Montpelier was a new record low for the date (NERCC).

Weather was excellent for fall foliage development with sunny days (seldom seen during the summer), cool nights, and a late hard frost in most locations. These conditions, combined with ample precipitation during the growing season, led to brilliant fall colors, particularly on red maples and white ash. Sugar maple foliage was variable because of anthracnose, heavy seed and insect damage, but browning was less noticeable than in 1999. Several snowfalls in early October coated the mountain tops and added to the spectacle. Foliage dropped earlier than normal at higher elevations, which has been observed in other wet years.

Fall color and leaf drop, at monitoring sites around Mount Mansfield, were similar to recent years but varied between hillsides (Figure 2b). The 8 study sites have been monitored since 1997. Color and leaf drop were earlier than usual at the high elevation site (4H). This site and 2 others had significant browning, probably due to leaf diseases. Up to 30% of the foliage on these hillsides was affected. Colors started to change unusually slowly at one site (3), in part due to species composition. Ash and beech leaves tend to change color later than other species. The foliage viewing period was longer than usual in 2000. Maximum color, before leaf drop, was maintained over 8 days.

The heavy flowering occurred on a variety of species, with most successfully producing seed. Statewide, white pine were laden with cones, leaving little foliage at the tops of many trees. Some were so bent and brown with cones that they were mistaken for dead tops. Heavy seed was also reported for sugar maple, red maple, beech, oak, black walnut, hickory, hophornbeam, linden, mountain maple, spruce, balsam fir, hemlock, winterberry, choke cherry, and pin cherry. Acorns and other nuts were generally larger than normal, probably due to the ample water supply. Wild apple production was spotty, due to wet weather at the time of pollination and scab disease.

A large number and variety of fungi were fruiting on the forest floor in the fall.



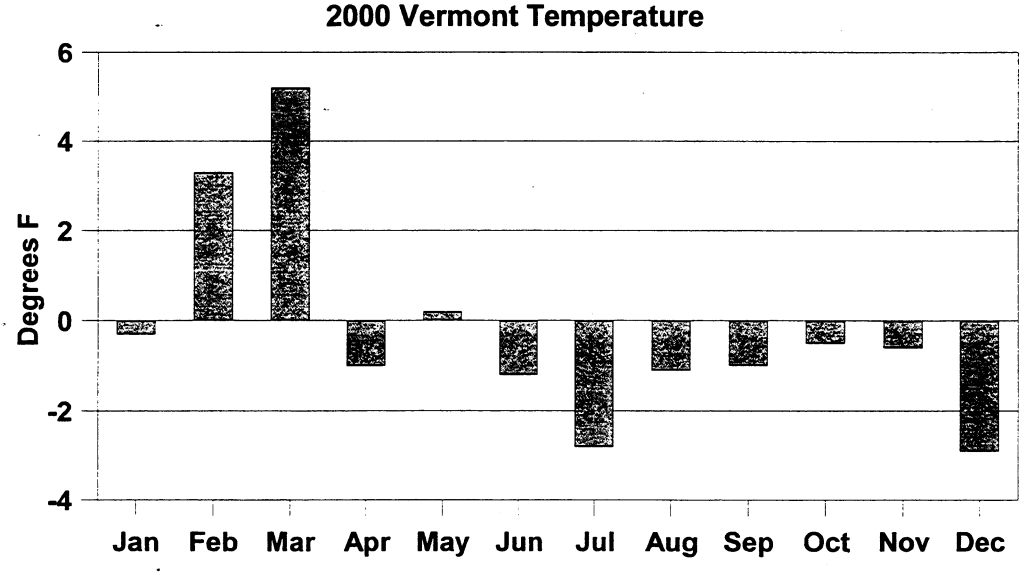
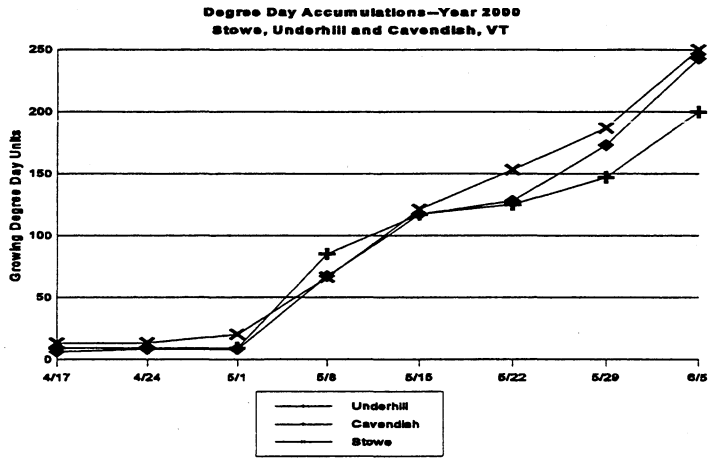
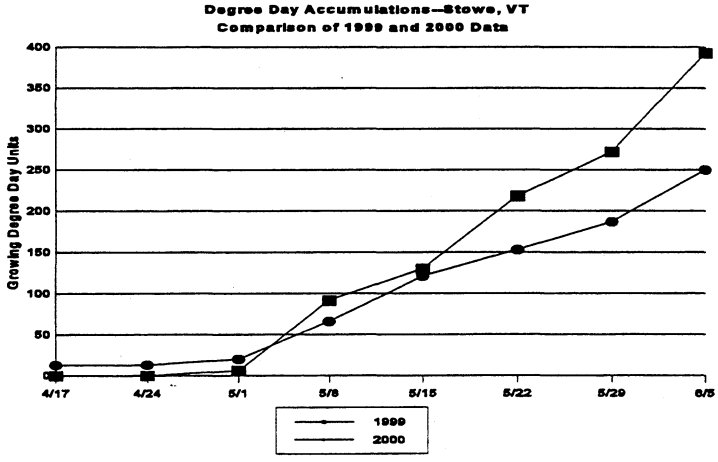


Figure 1. Monthly average departure from normal for precipitation and temperature in 2000. Data from the Northeast Regional Climate Center, Ithaca, NY.





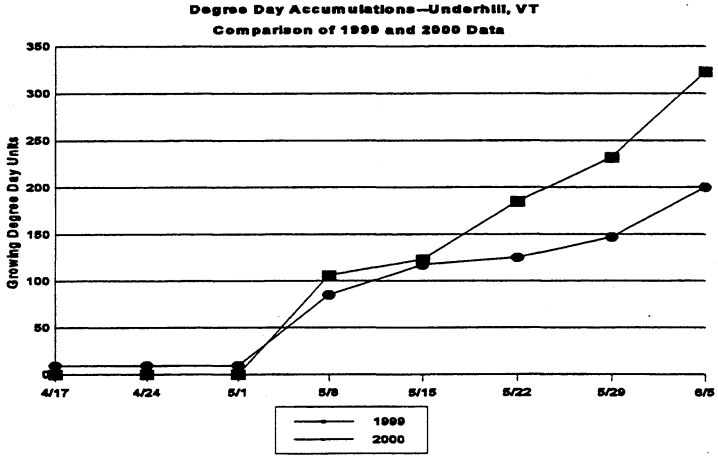


Figure 2a. Weekly spring cumulative growing degree days at Stowe, Underhill, and Cavendish in 2000, and 1999-2000 in Stowe and Underhill. 50 degrees F is used as the threshold of development.

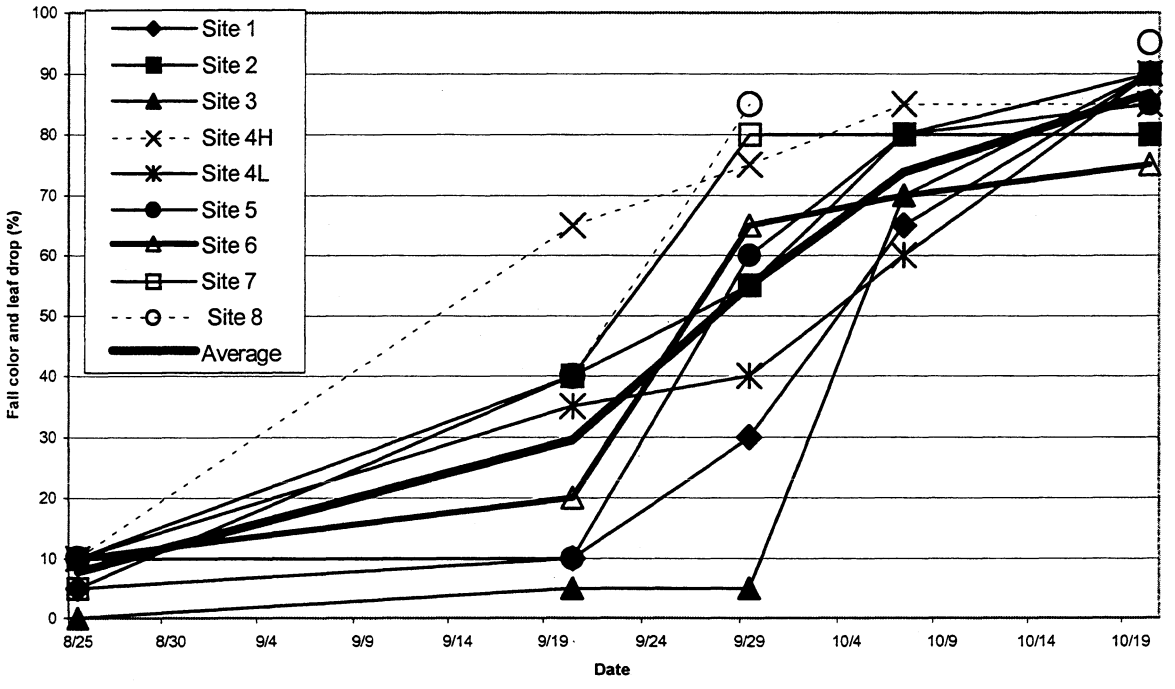


Figure 2b. Timing and duration of fall color and leaf drop at 8 hillsides near Mount Mansfield.

Table 1. 2000 Growing degree day accumulations and first observation dates of phenological development in 3 sites in Vermont. 50 degrees F is used as the threshold of development. 1999 data are provided for comparison.

Biological Indicator	Springfield		Stowe		Underhill	
PLANT DEVELOPMENT	1999	2000	1999	2000	1999	2000
Showing Green						
Balsam Fir			37 (5/3)	44 (5/5)	95 (5/7)	97 (5/9)
Fraser Fir			93 (5/7)	153 (5/21)		
Budbreak						
Ash		34 (5/6)				
Balsam Fir		45 (5/7)	46 (5/4)	50 (5/6)	111 (5/10)	124 (5/22)
Fraser Fir			130 (5/15)	187 (5/29)		
Hemlock	133 (5/22)	107 (5/12)	173 (5/18)	147 (5/20)	163 (5/18)	141 (5/26)
Red Maple	0 (4/8)					
Red Oak		17 (5/5)				
Sugar Maple	2 (4/25)	8 (4/24)	0 (4/17)	20 (5/3)	54 (5/4)	97 (5/9)
White Ash		34 (5/6)			54 (5/4)	97 (5/9)
Flower Budbreak						
Lilac			190 (5/19)	167 (5/27)		
Sugar Maple		6 (4/19)		20 (5/3)		
Flowers						
Black Cherry			76 (5/6)			
Dolgo Crab			117 (5/9)			
Elm		0 (4/1)				
Lilac	101 (5/17)	89 (5/9)			172 (5/21)	141 (5/26)
Lilac (Full Bloom)			240 (5/24)	207 (5/31)		
Popple/Aspen	0 (4/3)	0 (3/23)	0 (4/9)			
Red Maple	0 (4/8)		0 (4/15)	0 (4/8)	0 (4/13)	9 (4/17)
Red Maple (petal fall)			0 (4/18)			
Shadbush	83 (5/10)	9 (5/4)			95 (5/7)	85 (5/8)
Silver Maple		0 (3/28)				
Sugar Maple			0 (4/17)	27 (5/4)	54 (5/4)	35 (5/5)
Tartarian Honeysuckle			206 (5/21)	197 (5/30)		

Biological Indicator	Springfield		Stowe		Underhill	
	1999	2000	1999	2000	1999	2000
Leaves						
Cherry		6 (4/18)				
Sugar Maple		8 (4/27)				
Full Green Up	88 (5/15)	236 (6/4)				
INSECT DEVELOPMENT						
Balsam Gall Midge (adults)			60 (5/5)			
Balsam Gall Midge (laying eggs)				66 (5/8)		
Balsam Shootboring Sawfly (adults)			11 (4/27)	13 (4/25)		
Balsam Shootboring Sawfly (laying eggs)			93 (5/7)	58 (5/7)		
Balsam Shootboring Sawfly (larval drop)			272 (5/29)	217 (6/1)		
Eastern tent caterpillar--1st nest		9 (5/4)				
European Snout Beetle (on s. maple)				300 (6/13)		
Maple Leafcutter (adults)		106 (5/11)	117 (5/9)	121 (5/15)		141 (5/26)
Pear Thrips (adults)	0 (4/7)	6 (4/20)	0 (4/9)	13 (4/20)	0 (4/9)	0 (4/8)
Plum Curculio (laying eggs)				177 (5/28)		
OTHER OBSERVATIONS						
Light frost damage to butternut			119 (5/10)	147 (5/20)		
Spring Peepers calling			0 (4/11)	0 (4/3)		

OZONE SUMMARY

Ozone concentrations were generally low in 2000, in part due to rainy, cool weather. The maximum ozone levels at both Vermont stations were lower this year than in 1999 (Table 2). The Bennington station, which represents ozone concentrations for southern Vermont, peaked at .095 parts per million (ppm) on June 10th. The Underhill Station, which represents ozone concentrations for northern Vermont peaked at .087 ppm on May 4th.

Currently, we express ozone data in various ways that are more meaningful to plant health. Minimum ozone levels that adversely affect sensitive plant and tree species (i.e. black cherry and white ash) are from 0.060 to 0.080 ppm. The number of hours greater than 0.060 or 0.080 ppm, the SUM06, and the SUM08 are all indices used to relate ozone levels with potential plant injury. These indices reflect a cumulative exposure to ozone levels that are known to cause damage to sensitive plant species.

Ozone concentrations as expressed by all the different indices, reflect the low ozone season of 2000. Despite the relatively low ozone concentrations, there were still hundreds of hours over the field season when ozone concentrations were greater than .06 ppm at both sites. Ozone concentrations are usually higher at the Bennington station than at Underhill, as was true this year.

Table 2. Ozone levels recorded during the 2000 growing season (April through August) at two Vermont stations, Underhill and Bennington. Data provided by the Vermont Air Pollution Control Division.

Monitor Site	Total Number of Hours with		Maximum Level		SUM06 (ppm-hr)	SUM08 (ppm-hr)
	≥0.060 ppm	≥0.080 ppm	ppm	date		
Bennington	140	16	.095	06/10	9.444	1.395
Underhill	126	5	.084	05/04	8.341	0.412

Ozone injury symptoms were observed on sensitive plant species at 33% of the 18 monitoring locations surveyed throughout the state (Figure 3). The severity of foliage symptoms was light (1-2) on 4 plots and moderate on 2 plots [using a rating system of 0 (no injury) to 5 (<75% injury) on affected leaves]. No locations had heavy injury this year. Low ozone concentrations were the likely reason for limited injury to sensitive plants this year compared to other years. The overall effect of ozone injury to forest health is not currently known, but may include reductions in growth and vigor. No ozone damage was detected on forest trees from aerial surveys.

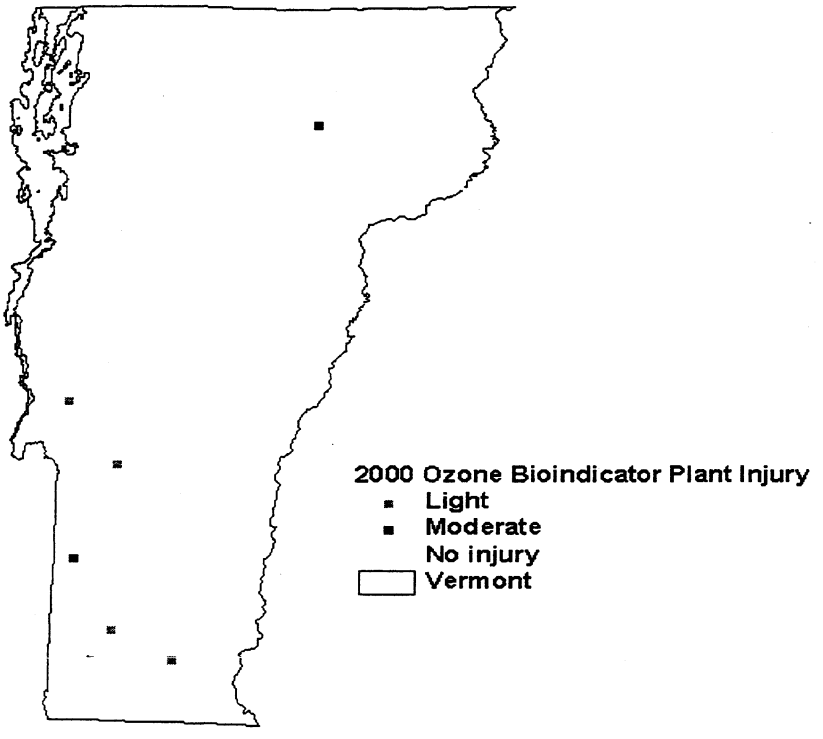


Figure 3. Approximate locations where ozone injury to sensitive plants was evaluated in 2000.

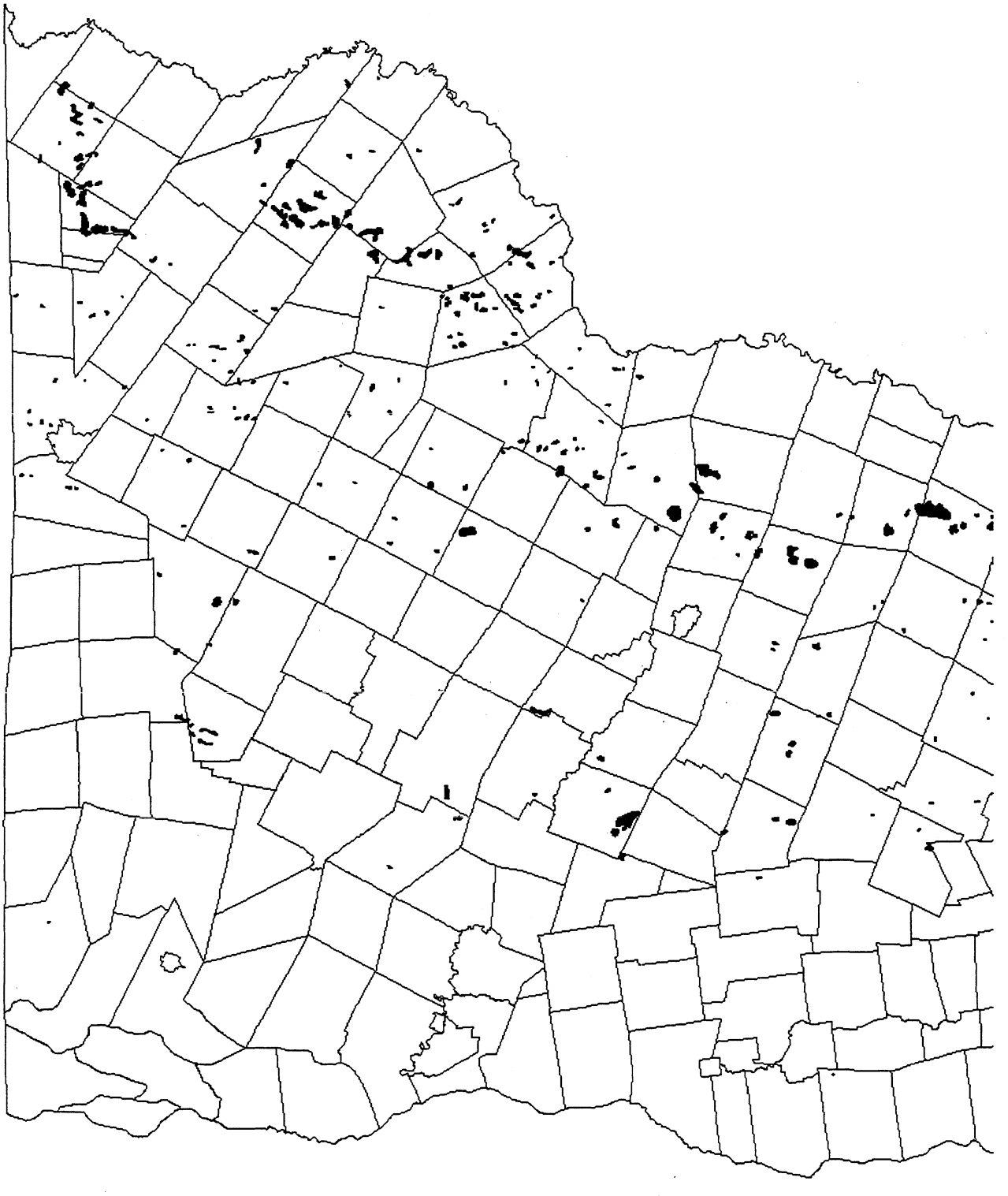
HARDWOOD DEFOLIATORS

Birch Defoliation, caused by **Birch Leaf Miners**, *Fenusa pusilla* and *Messa nana,* appeared to be common but at lower levels than in 1999. *F. pusilla* was observed to be emerging over a long period of time in Marshfield.

Brown birch mapped during aerial surveys was predominantly caused by fungus defoliation. Pathogens identified on symptomatic paper birch leaves included *Marsonnina betulae* and *Septoria betulae.* In all, 30,569 acres of birch defoliation were mapped in 2000, compared to 7,667 acres in 1999 (Table 3, Figure 4).

Table 3. Mapped acres of birch defoliation in 2000.

COUNTY	ACRES
ADDISON	210
BENNINGTON	199
CALEDONIA	5,759
CHITTENDEN	210
ESSEX	7,912
FRANKLIN	197
LAMOILLE	620
ORANGE	5,839
ORLEANS	1,504
RUTLAND	1,219
WASHINGTON	3,168
WINDHAM	1,127
WINDSOR	2,605
TOTAL	**30,569**



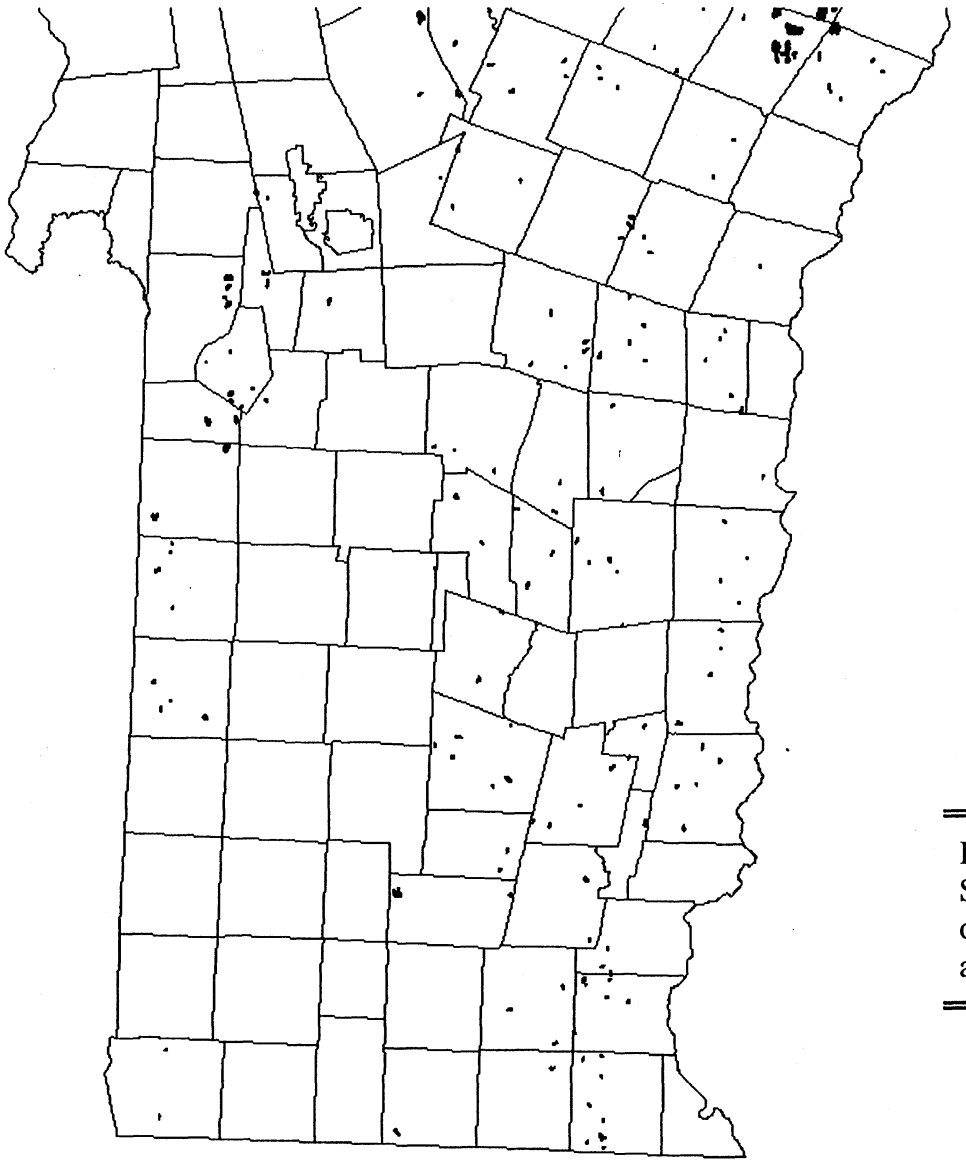


Figure 4. 2000 Birch browning from Septoria, anthracnose, birch leaf miners, and other defoliators. Mapped area is 30,569 acres.

Forest Tent Caterpillar, *Malacosoma disstria*, populations continued to be very low this year and no forest defoliation was observed. Few caterpillars were seen in northern Vermont, but were commonly observed in the southern counties, suggesting a population increase. Only one moth was caught in pheromone traps, at the Roxbury site (Figure 5-6). A Luminoc light trap in Hyde Park with a black light plus pheromone for four hours per night caught 0 moths compared to 2 moths in 1999.

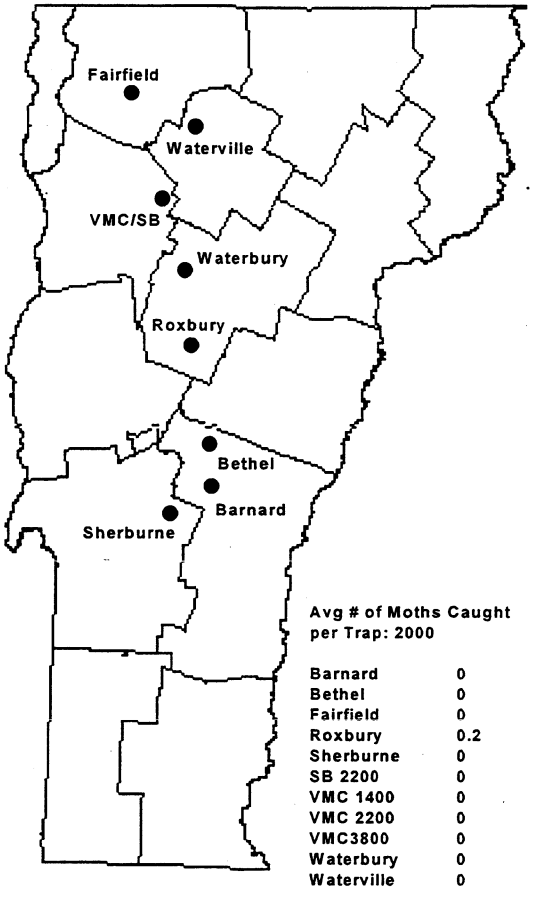


Figure 5 . Average number of forest tent caterpillar moths caught in pheromone traps, 2000. Average of 4-5 traps per location.

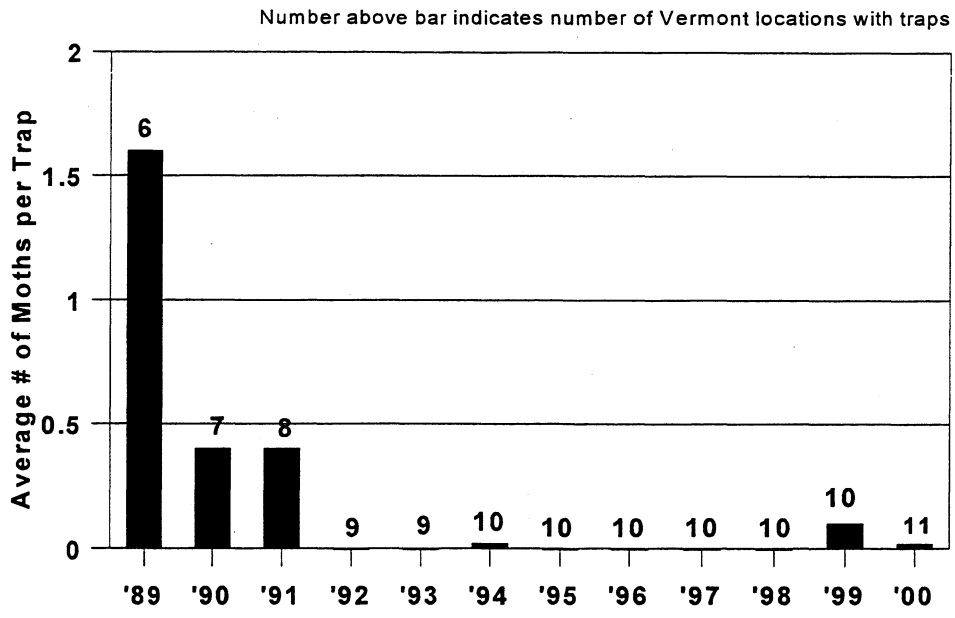


Figure 6. Average number of forest tent caterpillar moths caught in pheromone traps 1989-2000. Five multi-pher traps baited with RPC-2 component lures per location.

Gypsy Moth, *Lymantria dispar*, populations increased this year, but caused no significant defoliation. By late spring, groups of young larvae were frequently observed, but mortality was high. Dead larvae were common in burlap-banded plots in the fall. Many had died in early instars. Wet spring weather is thought to have led to a build-up of *Entomophaga*.

Male moths were nonetheless common, with individuals observed into mid-September. Egg mass counts from focal area monitoring plots increased slightly (Figures 7-8) but were generally sparse, with some new masses apparently without eggs. No widespread defoliation is expected in 2001. However, localized heavy defoliation is likely in a small forested residential area in Colchester (Chittenden County) where numbers of egg masses exceeded thresholds for predicting severe defoliation.

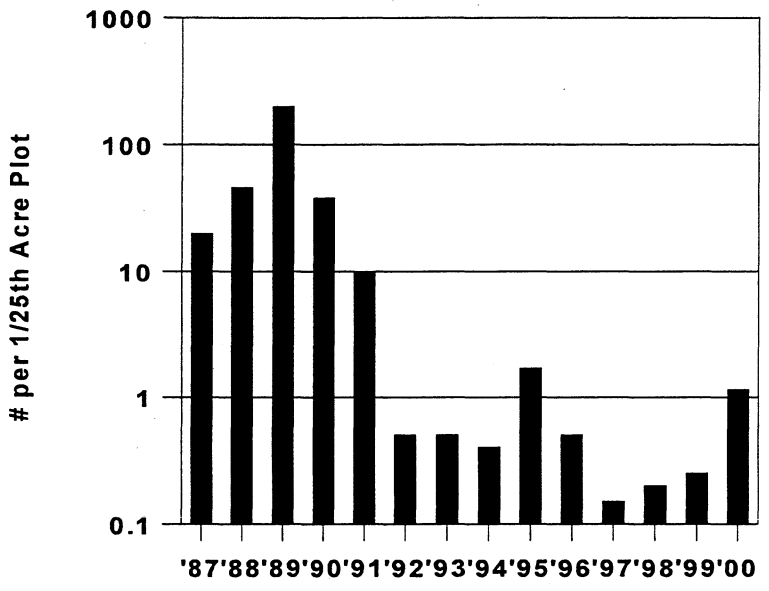


Figure 7. Gypsy moth egg mass counts from focal area monitoring plots, 1987-2000. Average of ten locations, two 15m diameter burlap-banded plots per location.

Large Aspen Tortrix, *Choristoneura conflictana*, was thought to be responsible for moderate-heavy leaf rolling, leaf tying and defoliation of quaking aspen in mid-June in the lower Connecticut and White River Valleys Damage occurred mostly in upper crowns. Light feeding was also observed in Essex County. In late June, clouds of moths were seen in Greensboro, and large blow-ins of moths were observed around parking lot lights in St. Johnsbury and Morrisville.

Locust Leaf Miner, *Odontata dorsalis,* caused heavy foliage browning to black locust in Putney and the Champlain Valley. Damage was mapped on 151 acres during aerial surveys (63 acres in Chittenden County, 17 acres in Franklin County, and 71 acres in Windham County). Damage elsewhere was light. Locust mortality continues in Hartland, caused by previous leaf miner defoliation.

Maple Leaf Cutter, *Paraclemensia acerifoliella*, increased this year. Adults were common in the spring, and heavy mining was observed in the lower foliage of some stands by mid-July. Damage occurred statewide, and was frequently heavy on leaves in the understory and in lower crowns (Figure 9). The most widespread damage to overstory trees was observed in Windsor and Orange Counties.

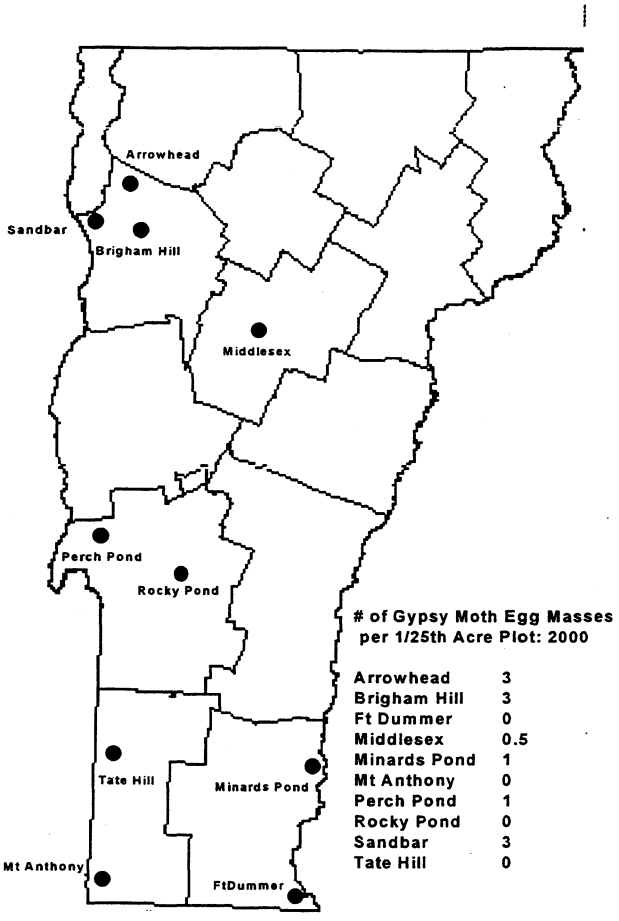


Figure 8. Gypsy moth egg mass counts from focal area monitoring plots, 2000. Average of two 15 meter diameter burlap-banded plots per location.

Hardwood browning which was mapped during aerial surveys was generally a combination of maple leaf cutter, anthracnose, and maple trumpet skeletonizer. A total of 73,095 acres of moderate to heavy defoliation was mapped (See Anthracnose) compared to 14,479 acres attributed to maple leaf cutter in 1999.

In early fall, at least half of the maple leaf cutter cases on the ground contained live insects in several stands checked in Windsor County. If overwintering survival is good, noticeable damage is expected in 2001.

Figure 9. Sugar maple leaves damaged by maple leaf cutter, August 2000.

Maple Trumpet Skeletonizer, *Epinotia aceriella,* was commonly observed on sugar maple. It was often present, associated with anthracnose and maple leaf cutter, in the 73,095 acres of defoliation mapped as hardwood browning. Populations increased from 1999 in northern Vermont and Bennington County. The heaviest damage was observed in the Northeast Kingdom and Windsor, Orange, & Washington Counties. One tree in Barnard had half of its leaves affected.

Saddled Prominent, *Heterocampa guttivata*, populations remain low with no defoliation of sugar maple detected . In southern Vermont, only early instar larvae were observed, and numbers were generally down from the previous year. Pheromone traps caught an average of only 0.4 moths per trap compared to 0.7 moths per trap in 1999 (Table 5).

Table 5. Number of saddled prominent moths caught in multi-pher pheromone traps in 1999 and 2000. Average of 3-4 traps per location.

Location	**Number of Moths per Trap**	
	1999	**2000**
Groton State Forest	1	0
Honey Hollow (Camel's Hump State Forest)	2	1
Shrewsbury	-	1
VMC1400	0	0
Ward	0.7	0.3
Westmore	0	0
Average	**0.73**	**0.38**

Striped Alder Sawfly, *Hemichroa crocea*, was responsible for 1,391 acres of paper birch defoliation in Westmore, Charleston and Brighton, near where their town lines meet. These areas were detected after the trees had mostly refoliated, totaling 37 acres in Caledonia County, 267 acres in Essex County and 1087 acres in Orleans County. This is the first time we have detected this sawfly. When the acres were ground checked in late September, unhatched eggs of a second generation were present within leaf petioles (Figure 10).

Figure 10. Striped alder sawfly oviposition sites on paper birch leaf petioles.

Viburnum Leaf Beetle, *Pyrrhalta viburni*, was identified from three locations in the Burlington area by Richard Hoebeke from Cornell University. A few adults and foliar damage were observed. This is the first record of this pest in Vermont. A native of Europe, this insect has recently caused heavy damage and mortality in New York state. A number of viburnum species are affected, including high-bush cranberry and arrowwood.

OTHER HARDWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Alder Leaf Beetle *Altica ambiens alni*	Speckled Alder	Essex & Washington Counties	Heavy damage along Route 114 in Essex County and in Calais.
American Aspen Beetle *Gonioctena americana*	Quaking Aspen	Lewis	Skeletonizing pole-size trees.

OTHER HARDWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
American Dagger Moth *Acronicta americana*			Not observed.
Apple-And-Thorn Skeletonizer *Choreutis pariana*	Crabapple	Stowe	Associated with apple scab, plum curculio or general leaf feeders.
Apple Leaf Skeletonizer *Choreutis pariana*	Crabapple	Stowe	Associated with apple scab, plum curculio or general leaf feeders.
Birch Leaf Folder *Ancylis discigerana*	Yellow Birch Paper Birch	Northeast Kingdom Stockbridge Granville	Widely scattered and very light.
Birch Leaf Miner *Fenusa pusilla*			See narrative on Birch Defoliation.
Birch Skeletonizer *Bucculatrix canadensisella*		Northeast Kingdom	Easily found, but lighter damage than in 1999.
Bruce Spanworm *Operophtera bruceata*		Widely scattered	Adults observed flying in November, but populations remain low.
Bud Moths *Family Tortricidae, Olethreutine*	Quaking Aspen	Derby	Isolated infestation.
Cankerworms *Family Geometridae*	Slippery Elm	Danville	Of minor concern.
Cecropia *Hyalophora cecropia*	Hardwoods	Starksboro Waterbury	Caterpillars and pupae occasionally seen.
Cherry Scallop Shell Moth *Hydria prunivorata*	Black Cherry	Springfield	Occasional nests. Elsewhere, not observed, though common in 1999.

OTHER HARDWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Cottonwood Leaf Beetle *Chrysomela scripta*	Cottonwood	Grand Isle	Significant numbers found along shoreline.
Early Birch Leaf Edgeminer *Messa nana*			See narrative on Birch Defoliation.
Eastern Tent Caterpillar *Malacosoma americanum*	Cherry Apple	Throughout	Very low populations. Observed occasionally.
Elm Leaf Beetle *Pyrrhalta luteola*			Not observed.
Elm Leaf Miner *Fenusa ulmi*	American Elm	Orleans County	Found along a road. Populations down.
Euonymous Caterpillar *Yponomeuta cagnagella*	Euonymous	West Rutland	Hedge.
European Snout Beetle *Phyllobius oblongus*	Sugar Maple	Irasburg Orleans	Seen on shade and ornamental trees.
Fall Cankerworm *Alsophila pometaria*			Not observed.
Fall Webworm *Hyphantrea cunea*	Hardwoods	Widespread	Moderate to heavy damage. Increased from 1999 in some western counties.
Flat Leaftier *Psilocorsis reflexella*	Beech	Newfane	Light population.
Flea Beetles *Family Chrysomelidae, Alticinae*	Raspberry	Newfane	Heavy damage, species undetermined.

OTHER HARDWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Forest Tent Caterpillar *Malacosoma disstria*			See narrative.
Green Striped Mapleworm *Anisota rubicunda*	Sugar Maple	Springfield	Moth at lights.
Gypsy Moth *Lymantria dispar*			See narrative.
Half Winged Geometer *Phigalia titea*			Not observed.
Imported Willow Leaf Beetle *Plagiodera versicolora*	Black Willow	Addison Chittenden Franklin Grand Isle Counties	Some moderate defoliation. Stable populations.
Japanese Beetle *Popillia japonica*	Many	Throughout	Common. High populations in southern Vermont. Spreading outside its traditional range with big increases in Derby and St. Johnsbury.
Large Aspen Tortrix *Choristoneura conflictana*			See narrative.
Linden Looper *Erannis tilaria*			Not observed.
Locust Leaf Miner *Odontata dorsalis*			See narrative.
Maple Basswood Leaf Roller *Sparganothis pettitana*		Caledonia Lamoille Windsor Counties	Scattered light damage. Seen for the first time in many years.
Maple Leaf Cutter *Paraclemensia acerifoliella*			See narrative.

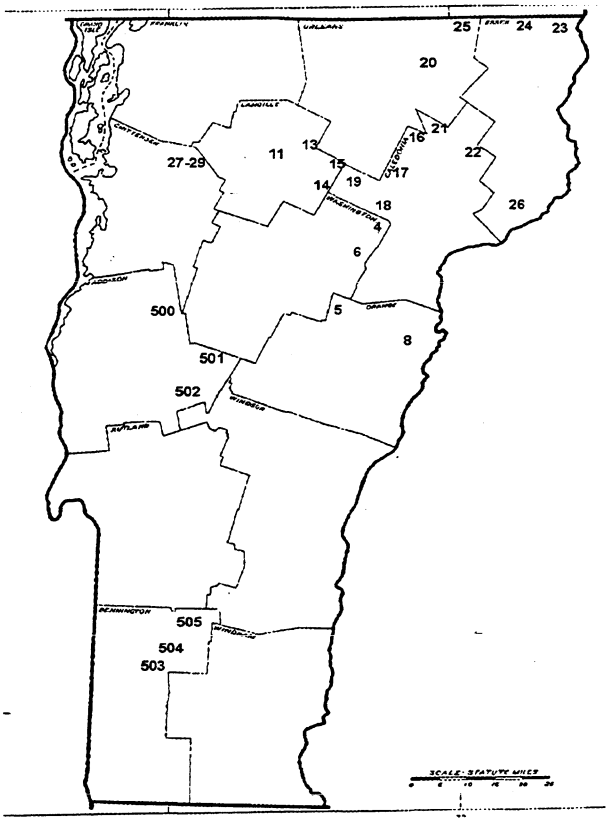
OTHER HARDWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Maple Leafblotch Miner *Cameraria aceriella*			Not observed.
Maple Trumpet Skeletonizer *Epinotia aceriella*			See narrative.
Maple Webworm *Tetralopha asperatella*			Not observed.
Measuring Worms (Geometrids) *Family Geometridae*	At Large	St. Johnsbury	Large larvae; species not determined.
Mountain Ash Sawfly *Pristiphora geniculata*	Mountain Ash	Newport Brattleboro	Ornamentals.
Nepticulid Moths *Nepticula sp.*	Poplar	Milton	Causing unique fall color patterns in poplar leaves.
Oak Leaf Tier *Croesia semipurpurana*	Oak	Champlain Valley	Low.
Oak Skeletonizer *Bucculatrix ainsliella*	Red Oak	Rutland County	Populations declined. Individual pupal cases observed.
Oak Slug Sawfly *Caliroa fasciata*			Not observed.
Orange-humped Mapleworm *Symmerista leucitys*	Hardwoods	Scattered	Individual larvae.
Pear Sawfly *Caliroa cerasi*	Pear	Danville	Moderate damage.

OTHER HARDWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Poplar Hawk Moth *Pachysphinx modesta*	Poplar	Lincoln	Occasional.
Polyphemus Caterpillar *Antheraea polyphemus*	White Ash	Shrewsbury	Individual cocoon.
Red-humped Oakworm *Symmerista canicosta*	Beech	Rockingham	Individual larva.
Redbanded Leafroller *Argyrotaenia velutinana*	Apple	Brattleboro	Feeding on fruit and foliage.
Rose Chafer *Macrodactylus subspinosus*	Roses Berries Crabapples	Widespread	Common on ornamentals. Mostly scattered light to moderate damage.
Saddled Prominent *Heterocampa guttivata*			See narrative.
Sallow (Cuculliinae) *Cuculliinae (Family Noctuidae)*	Beech	Newport Town	Caterpillars in understory.
Satin Moth *Leucoma salicis*	Quaking Aspen	Irasburg Coventry Hyde Park Hartland	Heavy defoliation to isolated trees or small stands by mid-June. Elsewhere, decreased from 1999, with only scattered light defoliation of white poplar.
Spiny Elm Caterpillar *Nymphalis antiopa*			Not observed.
Spring Cankerworm *Paleacrita vernata*			Not observed.
Striped Alder Sawfly *Hemichroa crocea*			See narrative.

OTHER HARDWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Uglynest Caterpillar *Archips cerasivoranus*	Cherry	North, Central, and Northeastern Vermont	Common, but fewer sightings than in 1999.
Viburnum Leaf Beetle *Pyrrhalta viburni*			See narrative.
White Marked Tussock Moth *Orgyia leucostigma*	Many	Widely scattered	Individual larvae.
Willow Flea Beetle *Rhychaenus rufipes*	Willow	Champlain Valley	Common throughout. 31 acres mapped in Franklin County.

SOFTWOOD DEFOLIATORS

Spruce Budworm, *Choristoneura fumiferana*, continued at low levels, with no visible defoliation detected. However, the number of moths captured in pheromone traps in northern Vermont jumped to the highest level seen since the end of the last outbreak in 1983 (Figures 11-12). This remains below the threshold for initiating other types of surveys, but it will be interesting to see what the moth catch is like in 2001.



Location No.	Name	# of moths/trap
4.	Danville Hill	15.0
5.	Reservoir	20.0
6.	Marshfield Pd.	3.7
8.	Scotch Hollow	16.0
11.	Centerville	25.7
14.	Wolcott F&G	13.0
15.	Bear Swamp	21.3
16.	Withers	63.3
17.	Mason	43.0
18.	Star School	85.0
19.	Beagle Club	93.0
20.	Brownington Pd.	73.0
21.	Calendar Brk.	34.7
22.	Chieppo	30.0
23.	Tin Shack	14.0
24.	Norton Cem.	29.7
25.	Holland Pd.	29.3
26.	Victory Bog	31.7
27.	VForEM 1400	24.7
28.	VForEM 2200	4.7
29.	VForEM 3800	47.7
	Average (excluding 28, 29)	**35.1**

Figure 11. Spruce budworm pheromone plot locations and average number of moths caught per trap in 2000.

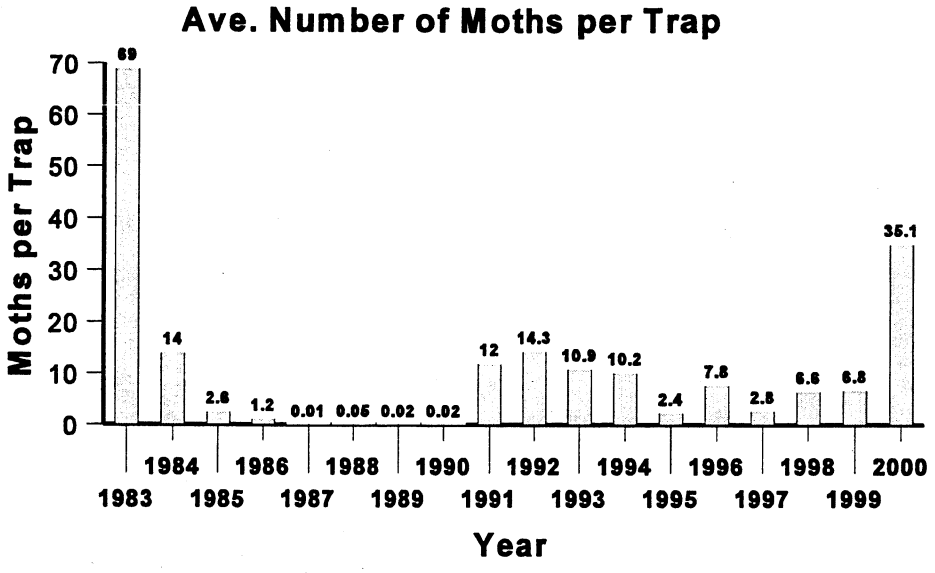


Figure 12. Average number of spruce budworm moths caught in pheromone traps, 1983-2000, based on 3 to 5 multi-pher traps per site for 15 to 23 sites.

OTHER SOFTWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Arborvitae Leaf Miner *Argyresthia thuiella*	Northern White Cedar	Addison Caledonia Chittenden Franklin Grand Isle Counties	Light defoliation. Populations increasing, with some dieback associated with this insect.
Balsam Fir Sawfly *Neodiprion abietis*			Not observed.
European Pine Sawfly *Neodiprion sertifer*	Scots Pine	Wells	Christmas trees.
European Spruce Needle Miner *Taniva albolineana*	Blue Spruce	Danville	On an ornamental.

OTHER SOFTWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
European Spruce Sawfly *Gilpinia hercyniae*	White Spruce	Andover	Individual larva. Associated with yellow-headed spruce sawfly.
Fall Hemlock Looper *Lambdina fiscellaria*	Hemlock	Windsor County	Moths commonly seen in early September, usually in hardwood stands.
Fir Coneworm *Dioryctria abietivorella*			Not observed.
Introduced Pine Sawfly *Diprion similis*	White Pine Scots Pine Mugo Pine	Barnet Danville Randolph	On ornamentals. On Christmas trees in Northern Vermont, lightly scattered, population down.
Larch Casebearer *Coleophora laricella*	Eastern Larch	Western Vermont	Increasing slightly in the Champlain Valley. Only light damage in Rutland County.
Larch Sawfly *Pristophora ericksonii*			Not observed.
Measuring Worms (Geometrids) *Family Geometridae*	Red Spruce	Cabot	Of minor concern.
Nursery Pine Sawfly *Diprion fruteorum*			Not observed.
Pine False Webworm *Acantholyda erythrocephala*			Not observed.
Pine Webworm *Tetralopha robustella*			Not observed.
Red-Headed Pine Sawfly *Neodiprion lecontei*			Not observed.

OTHER SOFTWOOD DEFOLIATORS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Sawflies *Family Tenthredinidea, Species Undetermined*	Spruce	Grand Isle	Significant defoliation, but sawflies were no longer present.
Spring Hemlock Looper *Lambdina athasaria*			Not observed.
Spruce Bud Moth *Zeiraphera canadensis*	White Spruce	Essex Caledonia Orleans Counties	Continued light damage. Decreasing.
Spruce Budworm *Choristoneura fumiferana*			See narrative.
White Pine Sawfly *Neodiprion pinetum*			Not observed.
Yellow-Headed Spruce Sawfly *Pikonema alaskensis*	White Spruce	Orleans & Caledonia Counties Andover Brookfield	Found on individual shade and ornamental trees in several towns. Associated with defoliation.

Balsam Gall Midge, *Paradiplosis tumifex*, remained at elevated population levels this year (Figure 13). Damage to wild forest trees and regeneration was the heaviest known. Cool spring conditions prolonged the oviposition period in many locations.

Of the balsam fir Christmas tree plantations visited in the northern Vermont survey, 49 acres received moderate damage, and 49 acres received light damage. Damage was more widespread than in 1999, including low-elevation physiographic regions in southern Vermont. A lot of heavy damage occurred in plantations that were not part of the annual survey, including many that had never had a gall midge problem in the past.

Damage should be lighter in 2001. Galls examined from several different plantations in late September revealed that the beneficial midge that controls the gall-maker (*Dasineura balsamicola*) was the most abundant midge present.

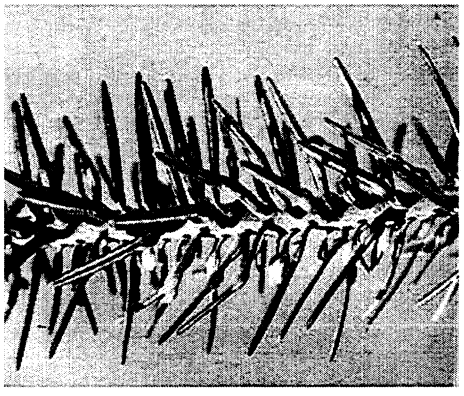


Figure 13. Balsam gall midge damage to current year's balsam fir needles, July 2000.

Balsam Twig Aphid, *Mindarus abietinus*, populations decreased with mostly scattered, light damage throughout the state. All of the northern balsam fir Christmas tree plantations surveyed this year had only light damage. Some heavy damage was observed on ornamental balsam fir in Waterbury, Berlin, and Grand Isle.

Oystershell Scale, *Lepidosaphes ulmi*, populations on American beech were light in most locations, and dieback was not heavy enough to be detected by aerial survey. However, populations of the scale insect in our survey plot in Huntington jumped to the highest levels seen in five years (Table 6, Figure 14). Since there seems to be about 4 to 5 years between peaks for this insect, damage may again be noticeable in 2001.

Table 6. Number of oystershell scales on current year beech twigs in Camel's Hump State Forest, 1993-2000[1].

	Average Number of Mature Viable Scales per:															
	Twig								Millimeter							
	1993	1994	1995	1996	1997	1998	1999	2000	1993	1994	1995	1996	1997	1998	1999	2000
Suppressed	1.2	2.1	9.0	0.6	2.1	4.0	0.7	2.9	0.03	0.07	0.15	0.06	0.15	0.10	0.50	0.25
Intermediate	1.4	8.4	16.8	1.2	2.6	3.3	2.8	12.1	0.05	0.16	0.31	0.12	0.10	0.25	0.14	0.66
Codominant	4.8	3.4	11.3	0.2	4.5	4.2	2.7	7.3	0.11	0.08	0.71	0.17	0.17	0.18	0.11	0.32

[1]Average for 10 branches from one tree per crown class, collected in Autumn, each year.

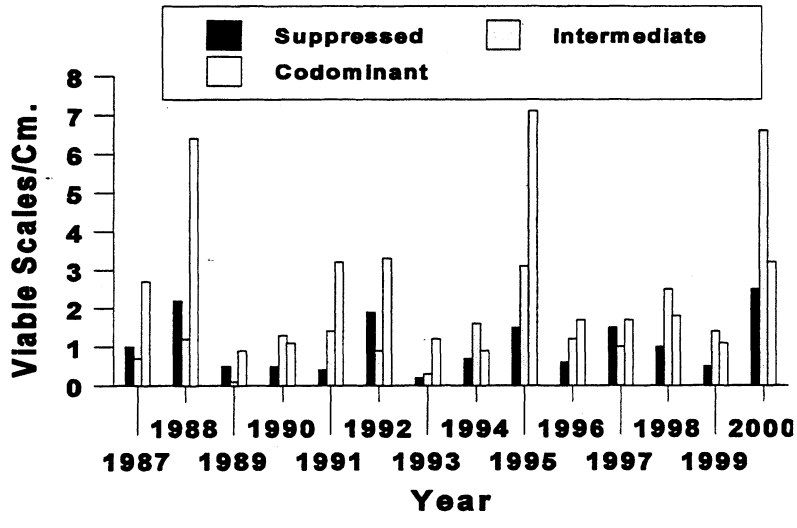


Figure 14. Oystershell scale populations in three tree canopy levels in Camel's Hump State Forest, 1987-2000[1]. Average for 10 current year twigs/tree per crown class, collected in autumn.

Pear Thrips, *Taeniothrips inconsequens*, populations were down from 1999 and little damage was observed. Some heavy damage to sugar maple was observed in Rochester and Pittsfield. Elsewhere, noticeable damage to sugar maple was light, and restricted to regeneration. Heavy oviposition scarring was observed on seed petioles in Sunderland. Other observations of thrips damage were on Norway maple in Rockingham and red oak in Townshend.

Yellow sticky traps were again placed in nine locations to determine adult emergence patterns and numbers. Peak emergence occurred during the third week in April, but the traps caught only about 29% as many thrips as were caught in 1999 (Figure 15-16).

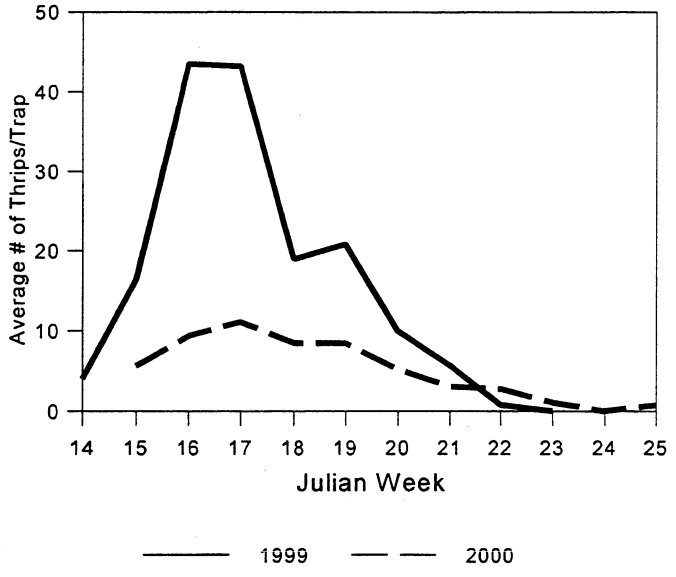


Figure 15 . Average number of thrips caught on sticky traps, 1999-2000, by week. Number is average of 9 sites and 4 Sentry Mulitguard 6"x8" sticky cards per site, attached to wooden stakes and replaced weekly.

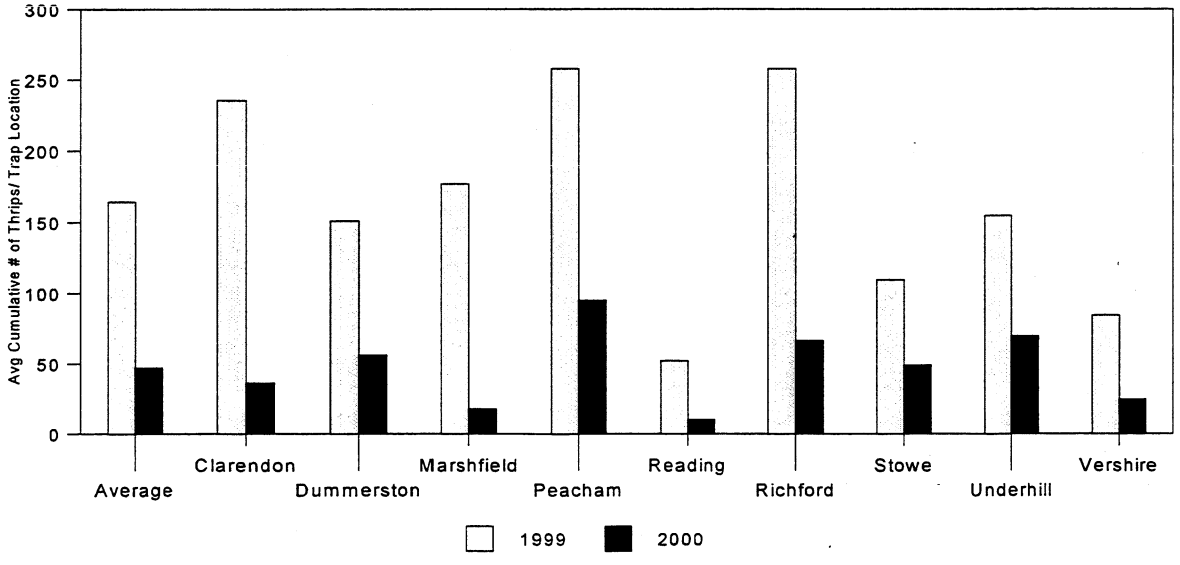


Figure 16. Seasonal number of pear thrips per sticky trap location, 1999-2000. Average of four locations per site, where Sentry Multigard 6"x8" sticky cards were attached to wooden posts and replaced weekly. Counts reflect cumulative numbers for the entire trapping season.

Spring thrips counts in buds were low in southern Vermont (Figure 17). As buds were opened during sampling, unusually high numbers of thrips were dead.

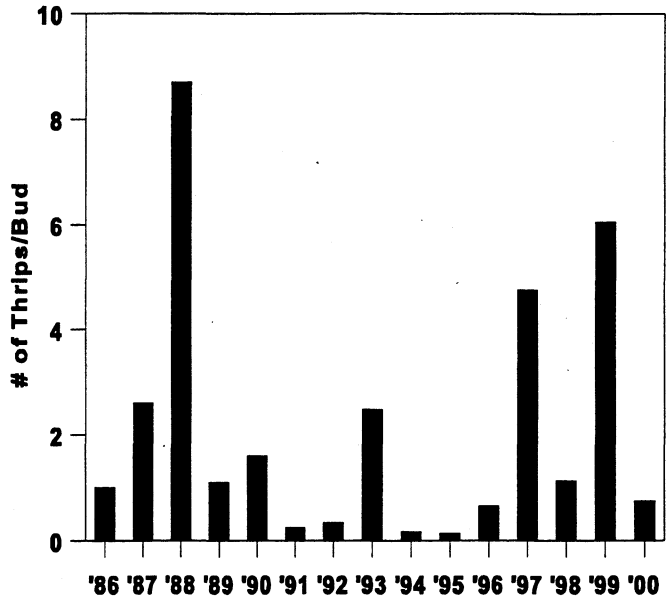


Figure 17. Spring thrips counts in buds of sugar maple in southern Vermont 1986-2000. Average of 2 sugarbushes in 1986, 5-6 sugarbushes 1987-2000 (100 understory buds/sugarbush).

Preliminary counts from soil samples collected in the fall of 2000 show an increase in the number of overwintering thrips adults (Figures 18-19). Populations were expected to rise because of the high availability of sugar maple pollen, which is associated with increased thrips fecundity. Although populations remained low in many stands, damage may be observed in spring 2001 if weather conditions prolong bud development.

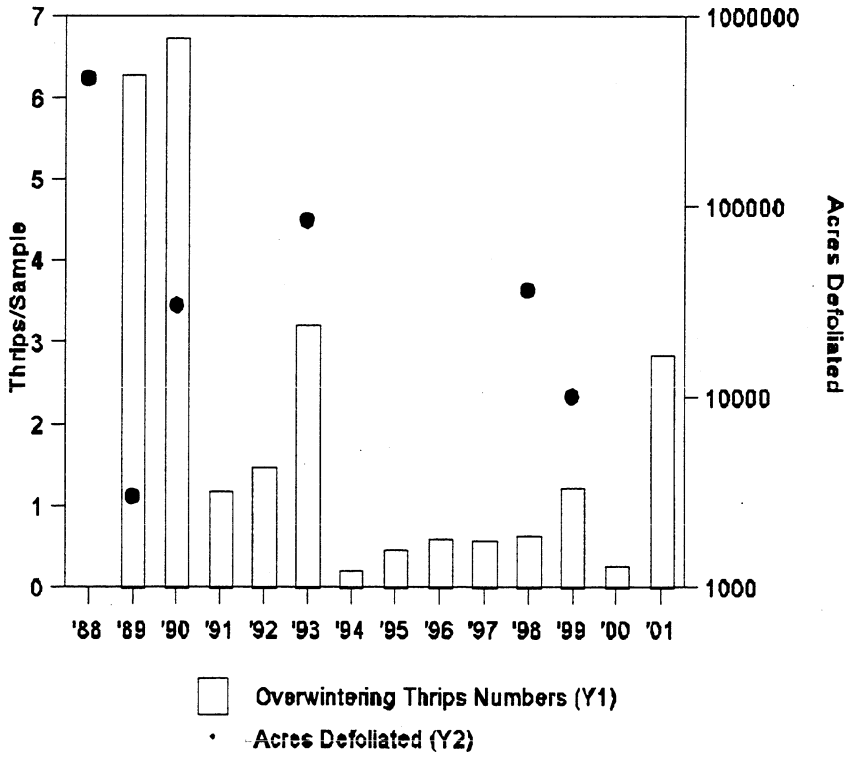


Figure 18. Average counts of overwintering pear thrips in soil samples (# of insects/16 in^3), compared to acres of thrips damage mapped statewide the following summer. Overwintering thrips numbers determined by extraction in 1989-93, and by forced emergence in 1994-2001. 44 sites were sampled to determine populations in winter 2000-01.

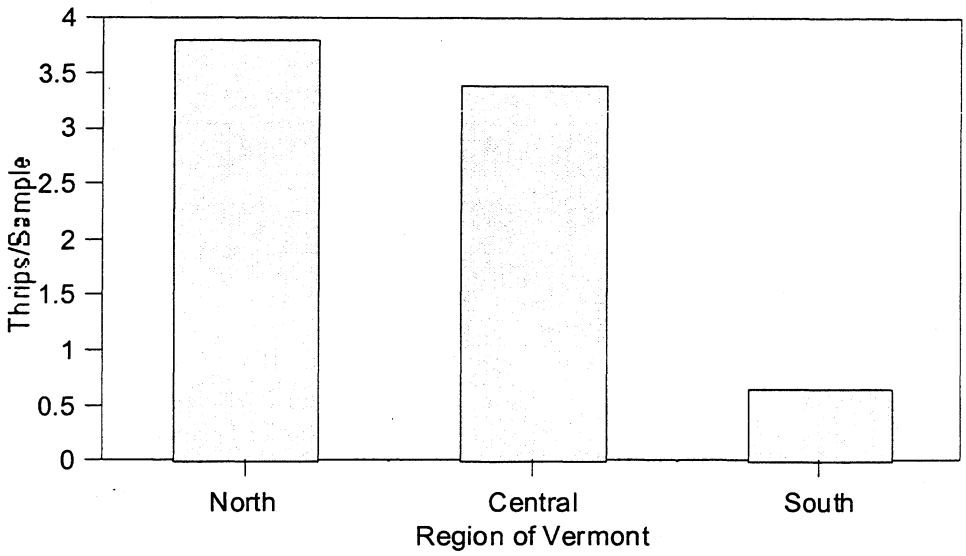


Figure 19. Average counts of overwintering pear thrips in soil samples (# of insects/16 in^3), by region, in Vermont. Overwintering thrips numbers determined by forced emergence. 44 sites were sampled to determine populations in winter 2000-01.

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Andromeda Lacebug *Stephanitis takeyai*	Andromeda	Brattleboro	Heavy stippling.
Aphids *Cinara sp.*			None observed this year, for the first time in many years.
Aphids *Family Aphididae*	Red Oak	St. Johnsbury	Considerable browning associated with aphid infestation.
Aphids *Periphyllus sp.*			Not observed.
Ash Midrib Gallmaker *Contarinia canadensis*	Ash	Morrisville	Seen as curiosity.

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Ash Plant Bug *Tropidosteptes amoenus*	Green Ash	South Hero	Nymphs feeding on lower leaf surface, producing spotting on upper surface.
Balsam Gall Midge *Paradiplosis tumifex*			See narrative.
Balsam Twig Aphid *Mindarus abietinus*			See narrative.
Balsam Woolly Adelgid *Adelges piceae*	Balsam Fir	Groton Granby	In Groton State Forest and heavy on a mature tree in Granby. First observations in many years.
Beech Blight Aphid *Fagifagus imbricator*	Beech	Bennington	Oak stand.
Beech Scale *Cryptococcus fagisuga*			See Beech Bark Disease.
Birch Catkin Bug *Kleidocerys resedae*	Birch	Waterbury	Numerous on some catkins.
Boxelder Bug *Leptocoris trivittatus*	Boxelder	Springfield Barre Walden	Common in houses.
Butternut Erineum Mite *Eriophyes cinereae*	Butternut	Waterbury	Erineum growth conspicuous on undersurface. Leaves appear swollen and puckered.
Cooley Spruce Gall Adelgid *Adelges cooleyi*	Blue Spruce White Spruce Norway Spruce	Widely scattered	Remains common on Christmas trees and ornamentals, mostly at low levels.
Cottony Maple Scale *Pulvinaria innumerabilis*	Silver Maple	Danby	Heavy on ornamental.

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Eastern Spruce Gall Adelgid *Adelges abietis*	White Spruce Red Spruce	Widespread	Remains common on ornamentals and Christmas trees, at mostly light levels.
Elongate Hemlock Scale *Fiorinia externa*	Hemlock	Rutland	Found in nursery setting.
Fletcher Scale *Parthenolecanium fletcheri*			Not observed.
Hemlock Woolly Adelgid *Adelges tsugae*	Hemlock		Not observed or known to occur in Vermont. Trap trees at introduction site were checked in May and October. No signs of adelgid were observed on these trees, or on suspect trees inspected in Brattleboro, Rutland, and Townshend.
Hickory Leaf Stem Gallmakers *Phylloxera spp.*	Shagbark Hickory	Essex Junction	Causing leaf and petiole galls.
Honeylocust Plant Bug *Diaphnocoris chlorionis*	Common Honeylocust	Richford Barre Johnson Enosburg	Moderate-heavy damage on some ornamentals.
Introduced Basswood Thrips *Thrips calcaratus*	Basswood	Hinesburg	Leaf curling and marginal blackening; lesions on stems.
Lacebugs *Corythucha sp.*	Alder	Shrewsbury	Associated with defoliation in wetland.
Lecanium Scale *Lecanium sp.*			Not observed.

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Maple Bladdergall Mite *Vasates quadripedes*	Silver Maple	Ferrisburg	Of minor significance.
Maple Spindle Gall Mites *Vasates aceris-crumena*	Sugar Maple	Scattered	Not common compared to other years.
Orabatid Mites *Orabatid mites*	Balsam Fir	Morrisville	Probably scavenging around bark.
Oystershell Scale *Lepidosaphes ulmi*			See narrative.
Pear Thrips *Taeniothrips inconsequens*			See narrative.
Phylloxerans *Phylloxera caryaecaulis*	Shagbark Hickory	Williston	Heavy damage to an ornamental.
Pine Bark Adelgid *Pineus strobi*	Eastern White Pine	Berlin	On ornamental.
Pine Fascicle Mite *Trisetacus alborum*	White Pine	Widespread	Was observed lightly damaging 16 acres of Christmas trees in surveyed plantations.
Pine Leaf Adelgid *Pineus pinifoliae*	White Pine	Widely Scattered	Light populations observed on 24 acres of surveyed Christmas trees.
Pine Needle Midge *Contarinea baeri*	Scots Pine	Scattered	Damaged increased, with 22 acres of light damage and 10 acres of heavy damage to surveyed Christmas trees. Not seen in 1999.
Pine Needle Scale *Chionapsis pinifoliae*	Mugho Pine	Charlotte	Light population. Trees under stress of compaction and wet soils.

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Pine Spittlebug *Aphrophora parallela*	White Pine	Springfield	Common in June. Not reported in Northern Vermont survey.
Pine Thrips *Gnophothrips sp.*			Not observed.
Pine Tortoise Scale *Toumeyella parvicornis*	Pine Eastern White Pine	Barre Town Morrisville	In Christmas tree plantation. Individuals found on an ornamental.
Ragged Spruce Gall Aphid *Pineus similis*	Red Spruce White Spruce	Widespread	Remains common.
Root Aphid *Prociphilus sp.*	Fraser Fir	Springfield	Associated with chlorosis and browning in young Christmas trees.
Scale Insects *Order Homoptera*	Beech Viburnum	Morrisville Concord	On ornamentals. Species undetermined.
Spider Mite *Oligonychus spp.*	Oak	Wallingford	Scattered stippling on leaves.
Spruce Gall Aphid *Adelges lariciatus*			Not observed.
Spruce Gall Midge *Mayetiola piceae*			Not observed.
Spruce Spider Mite *Oligonychus ununguis*	Fir White Spruce Blue Spruce	Scattered throughout	Mostly light damage in 2000. Although overwintering egg numbers indicated an increasing population, heavy rains may have prevented a build-up. Eggs present in winter 2000-2001 indicate mite damage may be noticeable in some trees in 2001.

OTHER SAPSUCKING INSECTS, MIDGES, AND MITES			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Taxus Mealybug *Dysmicoccus wistariae*	Arborvitae	Bridport	Lots of predatory mites associated with mealybug.
True Bugs *Order Hemiptera*	Azalea	Huntington	On ornamental. Species undetermined.
Twomarked Treehopper *Enchenopa binotata*	Viburnum	Waterbury	Gregarious adults.
White Pine Scale *Matsucoccus macrocicatrices*	White Pine	Grafton St. Johnsbury Springfield	Ornamental and roadside trees.
Woolly Alder Aphid *Prociphilus tessellatus*	Alder Silver Maple	Ludlow Montpelier Stowe Poultney	Isolated populations, sometimes heavy on individual trees.
Woolly Elm Aphid *Eriosoma americana*			Not observed.

BUD AND SHOOT INSECTS

Balsam Shootboring Sawfly, *Pleroneura brunneicornis*, damage was much more common than in 1999 but at mostly light levels for the Christmas tree plantations surveyed. Numbers of adults emerging in monitored plantations were greater than for the peak year of 1998, but cold wet weather appeared to depress egg laying. Fewer adults were caught on 3 x 5 yellow sticky cards placed in mid-crowns of trees in Lamoille County than in 1998, averaging 16.6 per card compared to 1.1 per card in 1999, and 64 per card in 1998 for the same two locations. Adults again emerged during the last week of April and the first week of May when weather was warm. Weather after emergence turned cold and wet. This slowed Fraser fir bud development so that damage to balsam fir and Fraser fir was about equal this year (compared to heavier damage to Fraser in many years).

Since damage is heaviest in even years and only light damage occurred in 1999 and 2000, growers should not experience any significant damage in 2001.

Pine Shoot Beetle, *Tomicus piniperda*, was the target of a re-survey in Franklin, Caledonia, Lamoille, Chittenden, Washington, Orleans and Grand Isle Counties. Five to ten lindgren funnel traps baited with alpha-pinene lure were placed in each county. One adult was trapped in Caledonia County, which is a new county record. Additional beetles were caught in Orleans County, but no damage could be detected. This is an introduced pest that prefers Scots pine and red pine. It kills pine shoots during the summer by boring into them. Trapping will be continued and expanded in 2001.

OTHER BUD AND SHOOT INSECTS

INSECT	HOST(S)	LOCALITY	REMARKS
Allegheny Mound Ant *Formica exsectoides*		Danville St. Johnsbury	Found in a few old pastures.
Balsam Shootboring Sawfly *Pleroneura brunneicornis*			See narrative.
Eastern Pine Shoot Borer *Eucosma gloriola*	White Pine Scots Pine	Scattered	Light damage on 22 acres of Christmas trees.
European Pine Shoot Moth *Rhyacionia buoliana*			Not observed.
Maple Petiole Borer *Caulocampus acericaulis*			Not observed.
Pales Weevil *Hylobius pales*	Balsam Fir	Bristol	Chronic problem in this plantation.

OTHER BUD AND SHOOT INSECTS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Pine Gall Weevil *Podapion gallicola*	Red Pine	Brookfield Thetford Waterbury Baltimore	Damage to ornamental and forest plantings.
Pine Shoot Beetle *Tomicus piniperda*			See narrative.
Twig Pruner *Elaphidionoides villosus*	Red Oak	Scattered	Moderate damage to ornamentals.
White Pine Weevil *Pissodes strobi*	White Pine Scots Pine Blue Spruce White Spruce	Throughout	Remains common but less damage than recent years. 42 acres of light damage and 40 acres of moderate damage to Christmas trees in surveyed area. Heavy damage to one white spruce Christmas tree plantation with 2 years' terminal growth killed.

BARK AND WOOD INSECTS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Ambrosia Beetle *Scolytidae*	Sugar Maple	Chester Springfield	Infesting dying transplants. Dying roadside tree.
Antlered Powder Post Beetle *Ptilinus ruficornis*	Butternut Lumber	Waterville	
Asian Longhorned Beetle *Anoplophora glabripennis*			Not detected or known to occur in Vermont.
Black Carpenter Ant *Camponotus pennsylvanicus*	Sugar Maple	Putney	Submitted from wound in large ornamental.
Bronze Birch Borer *Agrilus anxius*	Paper Birch European Birch	Scattered Groton Colchester Bennington	Associated with ice-storm damaged trees. Observed in Groton State Forest. Associated with dieback in ornamentals. Ornamentals.
Brown Spruce Longhorned Beetle *Tetropium fuscum*			Not detected or known to occur in Vermont.
Eastern Larch Beetle *Dendroctonus simplex*	Tamarack Japanese Larch	Rutland and Bennington County Northeast Kingdom Brattleboro	Common. Associated with larch mortality following larch casebearer. Associated with an increase in drought stress-related decline. On recently dead trees.
Elm Bark Beetles *Hylurgopinus rufipes* *Scolytus multistriatus*			See Dutch Elm Disease.

BARK AND WOOD INSECTS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Elm Sawfly *Cimbex americana*	Paper Birch	Fair Haven	On ornamental.
Flatheaded Borers *Chrysobothris spp.*	River Birch	Burlington	Found in dying birch planted in spring of 2000.
Hemlock Borer *Melanophila fulvoguttata*	Hemlock	Benson Williston New Haven	Heavy infestation detected in the spring on a ledgey site. Most infested trees still had healthy looking foliage. Heavy woodpecker activity. See Hemlock Decline.
Japanese Cedar Longhorned Beetle *Callidiellum rufipenne*			Not detected or known to occur in Vermont. Trap logs were placed in Bennington, in April and May, near young arborvitae trees with mimicking symptoms: longitudinal wounds and pitch on shoots and stems. No suspects were trapped.
Locust Borer *Megacyllene robiniae*	Black Locust	Hartland Guilford	Associated with locust mortality. Recent transplant.
Northeastern Sawyer *Monochamus notatus*	Conifers	Throughout	Frequently submitted as Asian longhorned beetle suspects.
Northern Pine Weevil *Pissodes approximatus*			Not observed.
Pigeon Tremex *Tremex columba*	Sugar Maple	Scattered throughout	Adults more commonly observed than normal. Holes in maple, on declining trees or in dead bark, occasionally reported.
Pine Engraver *Ips pini*	Red Pine White Pine	Chittenden County Springfield Dover	Some still attacking trees stressed by drought in 1999. Associated with pine mortality attributed to drought where root systems were compromised.

BARK AND WOOD INSECTS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Pine Root Collar Weevil *Hylobius radicis*			Not observed.
Pitted Ambrosia Beetle *Corthylus punctatissimus*	Sugar Maple	Orleans County	Killing regeneration.
Red Turpentine Beetle *Dendroctonus valens*	White Pine Red Pine	Chester Springfield	Pitch tubes.
Round-headed Apple Tree Borer *Saperda candida*	Apple Crabapple	Northeast Kingdom	Common problem on shade and ornamental trees.
Sawyer *Monochamus sp.*	Balsam Fir		No damage observed this year.
Sugar Maple Borer *Glycobius speciosus*	Sugar Maple	Throughout	Remains a common cause of defect on slow-growing maples. Stable levels.
Tanbark Borer *Phymatodes testaceus*	Red Oak	Cavendish	Firewood.
Teeny Weeny White Pine Beetle *Pityogenes hopkinsi*	White Pine	Grafton	Infesting branches broken off tree within 3 days of damaging storm in May.
Whitespotted Sawyer *Monochamus scutellatus*	Conifers	Throughout	Over 100 specimens submitted as Asian longhorned beetle suspects.
Zimmerman Pine Moth *Dioryctria zimmermanni*	Austrian Pine	Hartland	Associated with dead tops.

ROOT INSECTS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
A Scarab Beetle *Dichelonyx sp.*	Apple	Stowe	Associated with ornamental.
Conifer Swift Moth *Korsheltellus gracilis*			Not observed.
June Beetle *Phyllophaga spp.*		Throughout	Observed at lights.

FRUIT , NUT, AND FLOWER INSECTS			
INSECT	**HOST(S)**	**LOCALITY**	**REMARKS**
Ash Flowergall Mite *Aceria fraxiniflora*	White Ash	Hartland	Noticeable damage.
Hydrangia Leaf Tier *Exartema ferriferanum*	Hydrangia	Orleans St. Johnsbury	Ornamentals.
Japanese Beetle *Popillia japonica*	Plum	Johnson	Destroying the fruit.
Plum Curculio *Conotrachelus nenuphar*	Plum Shadbush	Stowe	Causing early fruit drop on plum.
Western Conifer Seed Bug *Leptoglossus occidentalis*	Conifer	Throughout	Readily entering homes and other structures for overwintering; not reported feeding on scales or seed pulp of conifer seeds.

MISCELLANEOUS INSECTS AND OTHER ARTHROPODS

Non-Target Moths Caught in Pheromone Traps used in surveys for forest tent caterpillar, saddled prominent, and spruce budworm were identified. Results are in Tables 7-9.

Table 7. Non-target moths caught in 2000 in pheromone traps baited with lure for forest tent caterpillar. Data are from 11 locations statewide.

Family	Species (Author)	Total Number Caught
Geometridae	*Besma endropiaria* (G. & R., 1867).	4
	Homochlodes disconventa (Wlk., 1860).	32
	Hydria prunivorata (Fgn., 1955).	1
	Probole amicaria (H.-S., 1855).	1
	Rheumaptera hastata (L.,1758).	2
Lymantriidae	*Lymantria (=Porthetria) dispar* (L., 1758).	38
Noctuidae	*Phlogophora periculosa* Gn., 1852.	1
	Zanclognatha laevigata (Grt., 1872).	5
	Zanclognatha ochreipennis (Grt., 1872).	2
Pyralidae	*Anageshna primordialis* (Dyar, 1907).	1
Tortricidae	*Choristoneura fumiferana* (Clem., 1865).	1

Table 8. Non-target moths caught in 2000 in pheromone traps baited with lure for saddled prominent. Data are from 6 locations statewide.

Family	Species (Author)	Total Number Caught
Geometridae	*Eutrapela clemataria* (J.E., Smith, 1917).	1
	Besma endropiaria (G. & R., 1867).	2
	Homochlodes disconventa (Wlk., 1860).	19
	Homochlodes lactispargaria (Wlk., 1861).	5
	Probole amicaria (H.-S., 1855).	1
	Selenia kentaria (G. & R., 1867).	1
Noctuidae	*Apamea lignicolora* (Gn., 1852).	1
	Bomolocha baltimoralis (Gn., 1854).	1
	Elaphria versicolor (Grt., 1875).	1
	Zanclognatha ochreipennis (Grt., 1872).	2

Table 9. Non-target moths caught in 2000 in pheromone traps baited with lure for spruce budworm. Data are from 21 locations statewide.

Family	Species (Author)	Total Number Caught
Arctiidae	*Halysidota tessellaris* (J.E. Smith, 1797).	2
Drepanidae	*Eudeilinia herminiata* (Gn., 1857).	7
Geometridae	*Campaea perlata* (Gn., 1857).	2
	Caripeta divisata Wlk., 1863.	6
	Dystroma truncata (Hufn., 1767).	1
	Homochlodes disconventa (Wlk., 1860).	13
	Horisma intestinata (Gn., 1857).	3
	Lambdina fiscellaria (Gn., 1857).	9
	Probole alienaria H.-S., 1855.	1
	Rheumaptera hastata (L., 1758).	1
	Scopula limboundata (Haw., 1809).	3
	Tetracis cachexiata Gn., 1857.	1
Lymantriidae	*Lymantria (=Porthetria) dispar* (L., 1758).	7
Noctuidae	*Acronicta fragilis* (Gn., 1852).	1
	Bomolocha baltimoralis (Gn., 1854).	2
	Charadra deridens (Gn., 1852).	1
	Leuconycta diphteroides (Gn., 1852).	2
	Palthis angulalis (Hbn., 1796).	1
	Parallelia bistriaris Hbn., 1818.	1
	Pseudaletia unipuncta Haw., 1809.	1
	Zanclognatha laevigata (Grt., 1872).	2
Pyralidae	*Anageshna primordialis* (Dyar, 1907).	29
	Phlyctaenia coronata (Hufn., 1767).	1
Tortricidae	*Clepsis persicana* (Fitch, 1856).	2

Though the organisms reported below were sent to the Forest Biology Lab for identification, they were not associated with trees or shrubs. Rather, they were found in households, on herbaceous plants, on humans or animals, or in other sites. Some were collected "at large", and therefore could not be associated with a particular host at the time of collection.

ORDER COLEOPTERA: BEETLES			
INSECT	**SITE FOUND**	**SCIENTIFIC NAME**	**LOCALITY**
Beaver Beetle	Wildlife	*Platpsyllus castoris*	Londonderry
Black Carpet Beetle	Household	*Attagenus unicolor*	Brookfield, Waterbury, Duxbury, Northfield
Blister Beetle	At Large	*Tricrania sanguinipennis*	Waterbury
Calligrapha	At Large	*Calligrapha sp.*	Waterbury
Carrion Beetles	At Large	Family Silphidae	Plainfield
Chlaenius tomentosus	At Large	*Chlaenius tomentosus*	Essex
Cigarette Beetle	Household	*Lasioderma serricorne*	Barre
Clover Curculio	Household	*Sitona sp.*	South Hero
Drugstore Beetle	Stored Food Product	*Stegobium paniceum*	Middlesex
Flea Beetles	Cranberry	Family Chrysomelidae, Alticinae	Morrisville
Goldsmith Beetle	Herbs	*Cotalpa lanigera*	Montpelier
Harmonia Lady Beetle	Eastern White Pine	*Harmonia axyridis*	Sherburne
Lady Bird Beetles	Ornamentals	Family Coccinellidae	Waterbury
Mealworms	Household	*Tenebrio spp.*	Lincoln
Rice Weevil	Stored Grains	*Sitophilus oryzae*	Springfield
Sawtoothed Grain Beetle	Stored Grains	*Oryzaephilus surinamensis*	Newport, St. Albans
Varied Carpet Beetle	Household	*Anthrenus verbasci*	Morrisville
White Grubs (Scarab Beetles)	Sugar Maple	Family Scarabaeidae	Waterbury

ORDER DIPTERA: FLIES			
INSECT	**SITE FOUND**	**SCIENTIFIC NAME**	**LOCALITY**
Blowfly	In Home	Family Calliphoridae	Morrisville
Crane Flies	At Large	Family Tipulidae	Royalton
Goldenrod Ball Gall	Goldenrod	*Eurosta solidaginis*	Newport
Ked	Human	Family Hippobscidae	Tinmouth
Midges	Aquatic	Family Chironomidae	Waterbury
Fruit or Vinegar Flies	Household	Family Drosophilidae	Rutland

ORDER HEMIPTERA: TRUE BUGS			
INSECT	**SITE FOUND**	**SCIENTIFIC NAME**	**LOCALITY**
Masked Hunter	Household	*Reduvius personatus*	Pittsford
Small Red-Black Stink Bug	Herbs	*Cosmopepla bimaculata*	Danville
Squash Bug	Curcubits	*Anasa tristis*	New Haven
Stink Bugs	Cranberry	Family Pentatomidae	Morrisville

ORDER HYMENOPTERA: ANTS, BEES, AND WASPS			
INSECT	**SITE FOUND**	**SCIENTIFIC NAME**	**LOCALITY**
Baldfaced Hornet	Nest on Home	*Dolichovespula maculata*	Norwich
Carpenter Ants	Structure	*Camponotus spp.*	St. Albans, Rutland
Cornfield Ant	Around Home	*Lasius alienus*	Pittsford
Ichneumons (Wasps)	At Large Beech	Family Ichneumonidae	Strafford Newbury
Leafcutting Bees	Structure	Family Megachilidae	Hyde Park
Pharaoh Ant	Structure	*Monomorium pharaonis*	Warrens Gore
Red Carpenter Ant	Wood Product	*Camponotus ferrugineus*	Burlington
Sphecid Wasps	At Large	Family Sphecidae	Bennington

ORDER LEPIDOPTERA: BUTTERFLIES AND MOTHS			
INSECT	**SITE FOUND**	**SCIENTIFIC NAME**	**LOCALITY**
Baltimore Checker Spot	Carrot	*Euphydryas phaeton*	Lincoln
Clothes Moths	Wool	Family Tineidae	Montpelier
Cutworms	At Large	Family Noctuidae	Rochester, Danville, Waterbury
Brush-Footed Butterflies	At Large	Family Nymphalidae	Waterbury
Hydrangea Leaftier	Hydrangea	*Exartema ferriferanum*	St. Johnsbury
Indianmeal Moth	Stored Food Product	*Plodia interpunctella*	Bristol, Barre, Burlington, Waterbury
Microbagworm	Lichens On Structure	*Psyche casta*	Waterbury Barre
Owlet Moth Caterpillars	Snow	Family Noctuidae	Royalton, Rochester
Pyralid Moths	Wood Product	Family Pyralidae	Wolcott

OTHER MISCELLANEOUS INSECT ORDERS			
INSECT	**SITE FOUND**	**SCIENTIFIC NAME**	**LOCALITY**
Springtails	In Home	Order Collembola	White River Junction, Burlington
Leafhoppers	Garden Sage	Order Homoptera Family Cicadellidae	Fair Harven
Dobsonfly/Helgrammite	Aquatic At Large In Home	Order Neuroptera *Corydalus cornutus*	Montpelier Waterbury, Montpelier Johnson
Stoneflies	At Large	Order Plecoptera	St. Johnsbury
Booklice	Household	Order Psocoptera Family Liposcelidae	Pittsford
Thrips	Hardwoods	Order Thysanoptera	Marshfield
Caddisflies	At large	Order Trichoptera	South Hero

ORDER ACARI: MITES AND TICKS			
ARTHROPOD	**SITE FOUND**	**SCIENTIFIC NAME**	**LOCALITY**
Clover Mite	Household	*Bryobia praetiosa*	Burlington
Grain Mites	Stored Food Product	Family Acaridae	Morristown
Deer Tick	Dog	*Ixodes scapularis*	Lincoln
	Human		Waterbury, White River Junction, Barre, South Hero
	Wildlife		Barre
	Cat		Plainfield
	Livestock		Fletcher
Moose or Winter Tick	Human	*Dermacentor albipictus*	Fairfield

ORDER ARANEIDA: SPIDERS			
ARTHROPOD	**SITE FOUND**	**SCIENTIFIC NAME**	**LOCALITY**
Barn Spider	In Home	*Araneus cavaticus*	Morrisville
Black Widow Spider	On Grapes	*Latrodectus sp.*	Burlington
Carolina Wolf Spider	At Large	*Lycosa carolinensis*	Out of State
Fishing Spider	At Large	*Dolomedes tenebrosus*	Chittenden, Springfield
Goldenrod Spider	Rugosa Rose	*Misumena vatia*	Barre
Jumping Spider	At Large	Family Salticidae	Lincoln
Nursery Web Spider	At Large	*Pisaurina mira*	Sudbury
Orb-Weaving Spider	On Person	*Araneus saevus*	Brandon

OTHER ORDERS OF ARTHROPODS			
ARTHROPOD	**SITE FOUND**	**SCIENTIFIC NAME**	**LOCALITY**
Centipedes	At Large	Class Chilopoda	Waterbury
Millipedes	Household	Class Diplopoda	Waterbury
Pseudoscorpion	On Walls in Home	Class Arachnida Order Pseudoscorpiones	Barre
	Household		Fayston

STEM DISEASES

Beech Bark Disease, caused by *Cryptococcus fagisuga* and *Nectria coccinea var. faginata* remained common. Chlorosis was less conspicuous than normal due to ample moisture available to trees. Only 1,395 acres were mapped during the aerial survey, compared to 4,004 acres in 1999 (Table 10).

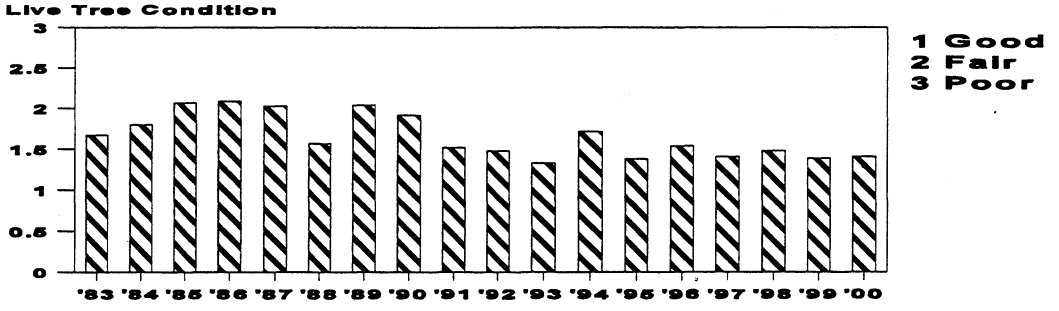
Tree condition improved in some monitoring plots, and worsened in others (Figure 20). The amount of beech scale, as indicated by wax cover present, increased from 1999. Dry conditions in 1999 may have allowed populations to build. Although *Nectria* fruiting was commonly observed statewide, levels in the plots were stable.

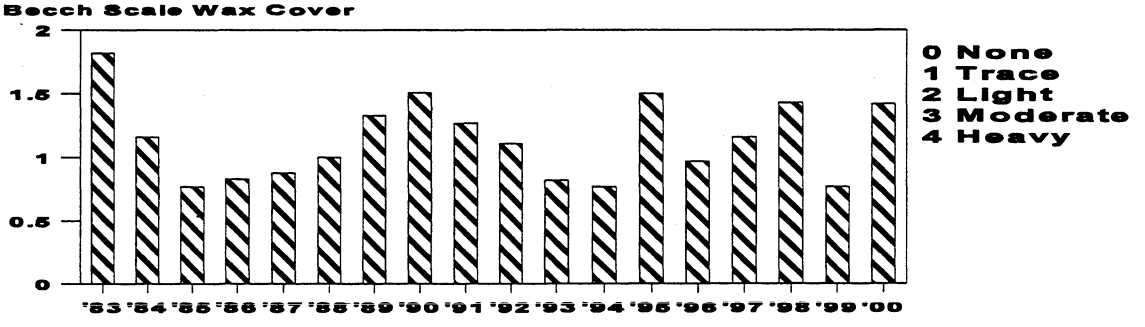
Table 10. Mapped acres of beech bark disease in 2000.

COUNTY	ACRES
BENNINGTON	38
CALEDONIA	68
ESSEX	187
FRANKLIN	115
LAMOILLE	133
ORLEANS	117
RUTLAND	20
WINDHAM	635
WINDSOR	82
TOTAL	**1,395**

Butternut Canker, caused by *Sirococcus clavigignenti-juglandacearum*, continues to cause widespread dieback and mortality of butternut statewide. Research continues at the University of Vermont Forest Pathology Laboratory on this fungus (Scj), and the vectoring ability of insects associated with butternut. The following report was submitted by Shari Halik and Dale Bergdahl regarding that research.

> "Beetles most commonly found carrying conidiospores of Scj were *Acoptus suturalis*, *Astylopsis macula*, *Eubulus parochus*, and *Hyperplatys maculata*, all frequently found on dead butternut material and occasionally in living butternut crowns. We are currently looking at the length of time conidiospores of Scj will survive and remain viable on exoskeletons of these beetles in the lab. Spores rinsed from artificially infested *A. macula* after 20 days were still viable, and beetles were carrying an average of 2900 conidiospores at that time. We have observed these beetles feeding on the sporulating structures of Scj in the field and have observed conidiospores of Scj in frass pellets of these beetles. To determine if these beetles carry viable conidiospores internally, we collected *A. macula* and *E. parochus* in the field and streaked their frass pellets onto 1.5% malt extract agar. Of the 339 A. macula and 86 *E. parochus* evaluated, 26% and 17%, respectively, carried viable conidiospores of Scj internally. Another beetle, the butternut curculio (*Conotrachelus juglandis*), is commonly found in the crowns creating feeding and oviposition wounds on new shoots and leaf rachises. Six to eleven percent of curculios collected from tree crowns were found to carry low numbers of





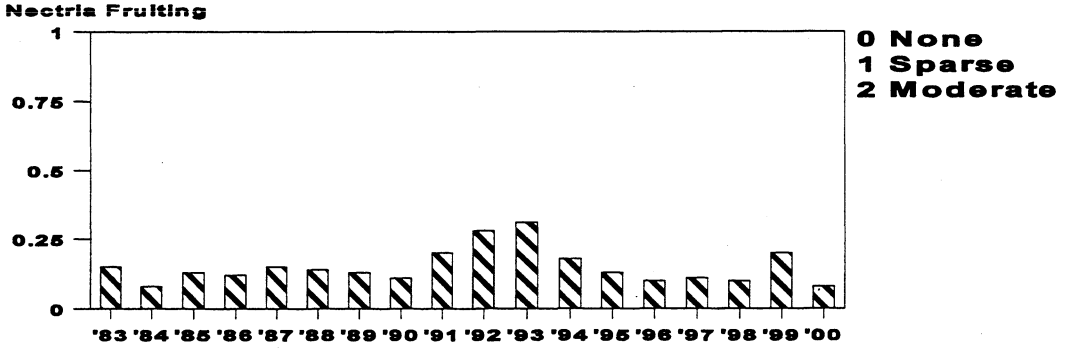


Figure 20. Average live tree condition, beech scale wax cover, and Nectria fruiting ratings, 1983-2000. Average of three southern Vermont locations, 1983-1992, and six to eight locations statewide, 1993-2000.

conidiospores of Scj, and we have isolated Scj from curculio wounds collected in the field. We have also caged curculios with butternut seedlings in the lab, artificially inoculated the curculio wounds with conidiospores of Scj, and were able to re-isolate the fungus from the tissue of all seedlings after four weeks. We then artificially infested curculios with Scj, placed them in cages with butternut seedlings, and were able to re-isolate Scj from the feeding and oviposition wounds on 67% of the seedlings. Species of Nitidulidae have been found burrowing into curculio wounds and butternut cankers in the field. A small percentage of these nitidulids were carrying conidiospores of Scj. Artificially infested nitidulids were found to carry condiospores for up to six days in the lab.

"Each of these beetles could be more important than we know in helping to spread Scj throughout the range of butternut and additional study is necessary to determine how effective they are as vectors. The fungus has been found naturally infecting black walnut (*Juglans nigra*) and heartnut (*Juglans ailantifolia* var. *cordiformis*), and a number of other species of *Juglans* are susceptible when inoculated. Many of the potential insect vectors we found are known to feed and breed in other hosts besides butternut and have the potential to spread Scj to butternut or other *Juglans* species in plantings or orchards. Management of the insects in these situations may help to reduce spread of the butternut canker fungus."

Scleroderris Canker, caused by *Ascocalyx abietina*, has not been found in any new towns since 1986. Eleven pine Christmas tree plantations within the quarantine zone (Figure 21), were surveyed for the presence of the disease this year and all were found free of the disease.

White Pine Blister Rust, caused by, *Cronartuim ribicola,* remains common statewide. Heavy (20-60%) incidence levels were observed in pole-sized stands in Hubbardton, Goshen, and Tinmouth. During the annual Christmas tree survey, light infection was reported for 75 acres and moderate infection was reported for 23 acres in northern Vermont. Some culling of infected trees has occurred in plantations previously reported to have heavy damage. Blister rust was observed causing scattered Christmas tree mortality in Wells.

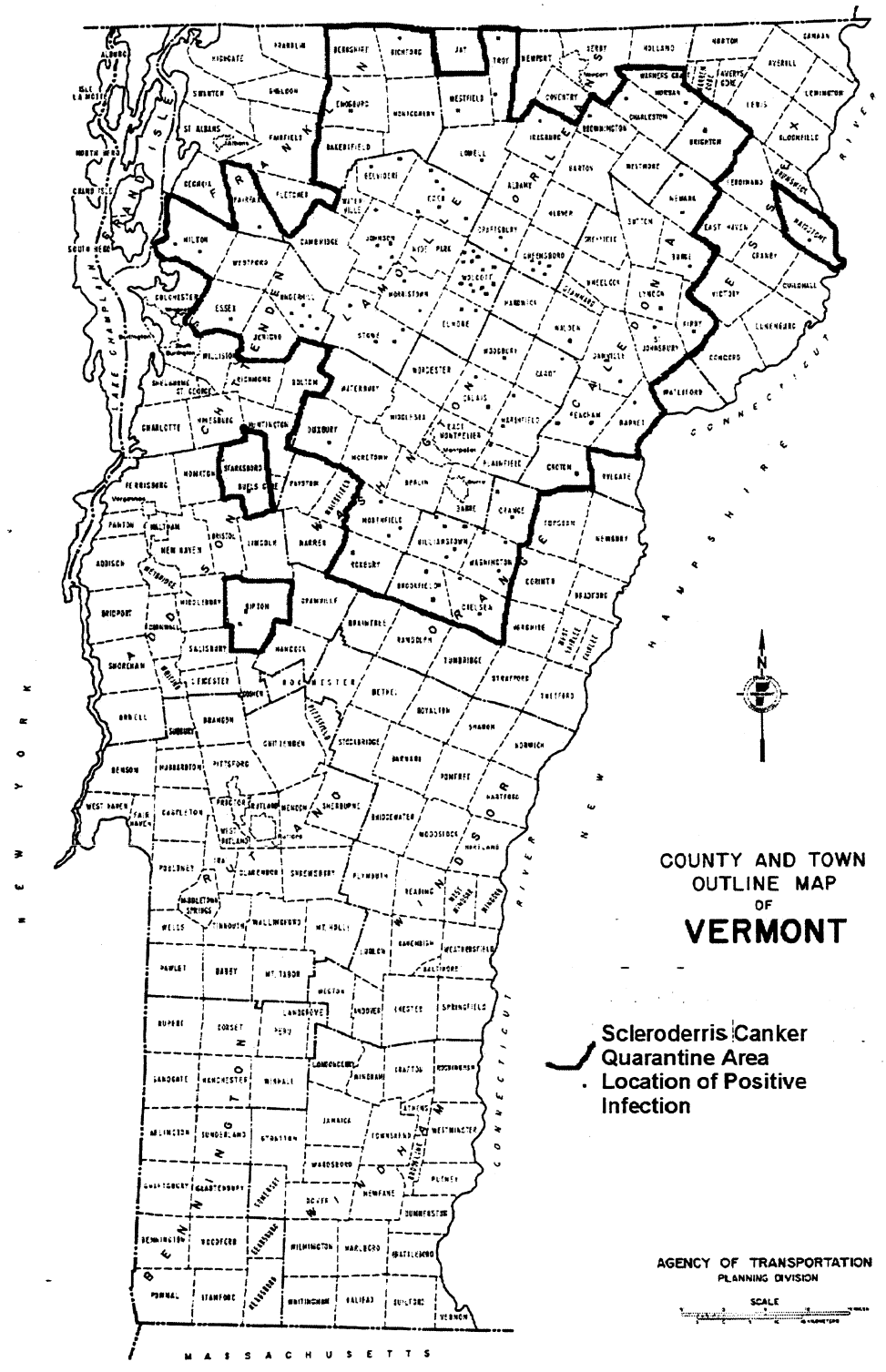


Figure 21. 2000 Scleroderris Canker quarantine area and location of positive infections.

OTHER STEM DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Annual Canker *Fusarium sp.*	Red Maple	Washington Orange Counties	
Ash Yellows *Mycoplasma-like organism*	White Ash	Widespread	Mortality continues at apparently stable levels.
Beech Bark Disease *Cryptococcus fagisuga* and *Nectria coccinea var. faginata*			See narrative.
Black Knot *Dibotryon morbosum*	Black Cherry	Throughout	Commonly seen.
Butternut Canker *Sirococcus clavigignenti-juglandacearum*	Butternut	Throughout	Remains a common cause of dieback and mortality. Trees without cankers occasionally observed in heavily infected stands.
Caliciopsis Canker *Caliciopsis pinea*	White Pine	Scattered	Larger cankers than normal observed in some Washington County stands.
Cedar-Apple Rust *Gymnosporangium juniperi-virginianae*	Red Cedar	Rutland County	Fruiting.
Chestnut Blight *Cryphonectria parasitica*	American Chestnut	Chittenden Windsor Windham Counties	Increasing. Heavy fruiting in May, and new infections observed. Apparently healthy 14" chestnut observed in Chester.
Coral Spot Nectria *Nectria cinnabarina*	Sugar Maple	Winhall	Recent transplants. Fungus is an opportunistic pathogen.
Cytospora Canker *Cytospora spp.*	Red Maple	South Burlington	Fungus may be saprophytic but has the potential to infect live tissue causing cankers and dieback.

OTHER STEM DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Cytospora Canker *Leucostoma kunzei*	Balsam Fir Blue, Norway & Birds Nest Spruce	Ira Widely scattered	Associated with top dieback. Common at stable levels.
Delphinella Tip Blight of Fir *Delphinella balsamae*	Balsam Fir	Danville Wolcott	Only light infection in Christmas trees this year.
Diplodia Shoot Blight *Diplodia pinea (Sphaeropsis sapinea)*	Balsam Fir Fraser Fir White Pine Scots Pine	Widespread	Remains common on Christmas trees but mostly at light levels.
Dutch Elm Disease *Ceratocystis ulmi*	Elm	Throughout	Mortality of young roadside elms continues at apparently stable levels. Symptoms more noticeable than normal in the spring. Wet springs result in larger xylem tubes, allowing the fungus to move more quickly through the wood, but dry conditions in 1999 may also have favored symptom development.
Eastern Dwarf Mistletoe *Arceuthobium pusillum*			Not observed.
Fireblight *Erwinia amylovora*	Apple Crabapple	Northeast Kingdom	Common on shade and ornamental trees.
Hypoxylon Canker *Hypoxylon pruinatum*	Aspen	Throughout	Remains a common cause of tree mortality and breakage, especially during the windstorms this summer.
Lilac Blight *Pseudomonas syringae (lilac)*	Common Lilac	Enosburg	Prevalent during wet springs such as this year.

OTHER STEM DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Maple Canker *Steganosporium spp.*	Sugar Maple	Shrewsbury	Found on twigs which had died back.
Oak Wilt *Ceratocystis fagacearum*			Not observed. No suspects seen during aerial surveys.
Phomopsis Twig Blight *Phomopsis spp.*	Common Horsechestnut	Manchester	Ornamental.
Red Ring Rot *Phellinus pini*	White Pine	Throughout	Common in stands with wind damage or wounding.
Sapstreak *Ceratocystis coerulescens*			Not observed.
Scleroderris Canker *Ascocalyx abietina*			See narrative.
Sirococcus *Sirococcus strobilinius*	Red Pine White Spruce	Groton Waterville	Only light damage observed.
Sumac Wilt *Fusarium sp.*	Staghorn Sumac	Brattleboro	A *Botryosphaeria* also present.
Tomentosus Butt Rot *Inonotus tomentosus*			Not observed.
Verticillium Wilt *Verticillium albo-atrum* or *V. dahliae*			Not observed.
White Pine Blister Rust *Cronartium ribicola*	White Pine	Throughout	See narrative.

OTHER STEM DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Woodgate Gall Rust *Endocronartium harknessii*	Scots Pine Mugo Pine	Throughout	Common in Scots pine Christmas tree plantations but at lighter levels. Heavy damage to ornamental in Stowe.
Yellow Witches Broom Rust *Melampsorella caryophyllacearum*	Balsam Fir	Throughout	Remains common in Christmas trees at mostly light levels.

FOLIAGE DISEASES

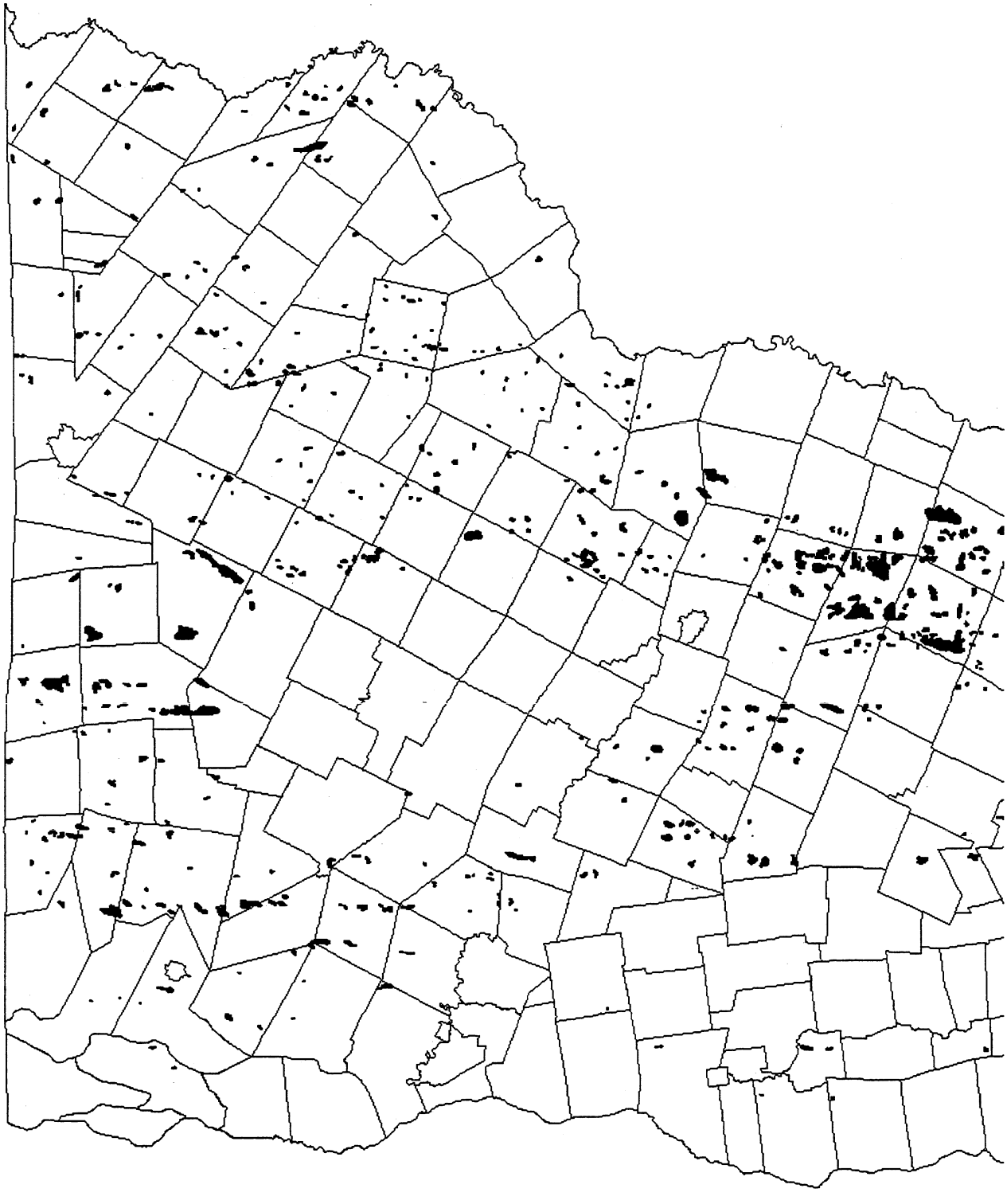
Anthracnose, caused on sugar maple by *Discula sp.*, was the common denominator for most of the hardwood stands mapped as having brown foliage during the aerial survey. In all, 73,095 acres were mapped (Table 11, Figures 22-23). Anthracnose, like other foliage diseases, was widespread in 2000 due to the wet spring and persistent humid conditions throughout the growing season. Other stressors contributing to the symptoms on sugar maple included maple leaf cutter, maple trumpet skeletonizer, and heavy seed production.

Anthracnose on red maple, caused by *Kabatiella apocrypta*, was widespread in northern Vermont, and observed elsewhere. Some hophornbeam stands in southern Vermont had heavy defoliation associated with *Monostichella robergei*. Other species with anthracnose, in some of the mapped areas, included beech affected by *Discula umbrinella*, yellow or paper birch affected by *Discula betulina*, and oak affected by *Discula quercina*.

Additional anthracnose observations, outside of mapped areas, are noted under Other Foliage Diseases.

Table 11. Mapped acres of hardwood browning in 2000. Causal agents included hardwood anthracnose and other foliar diseases, maple leaf cutter, heavy seed production, and maple trumpet skeletonizer.

COUNTY	ACRES
ADDISON	694
BENNINGTON	5,490
CALEDONIA	4,541
CHITTENDEN	2,293
ESSEX	3,687
FRANKLIN	7,417
GRAND ISLE	55
LAMOILLE	1,946
ORANGE	18,706
ORLEANS	5,797
RUTLAND	8,537
WASHINGTON	6,114
WINDHAM	2,724
WINDSOR	5,094
TOTAL	**73,095**



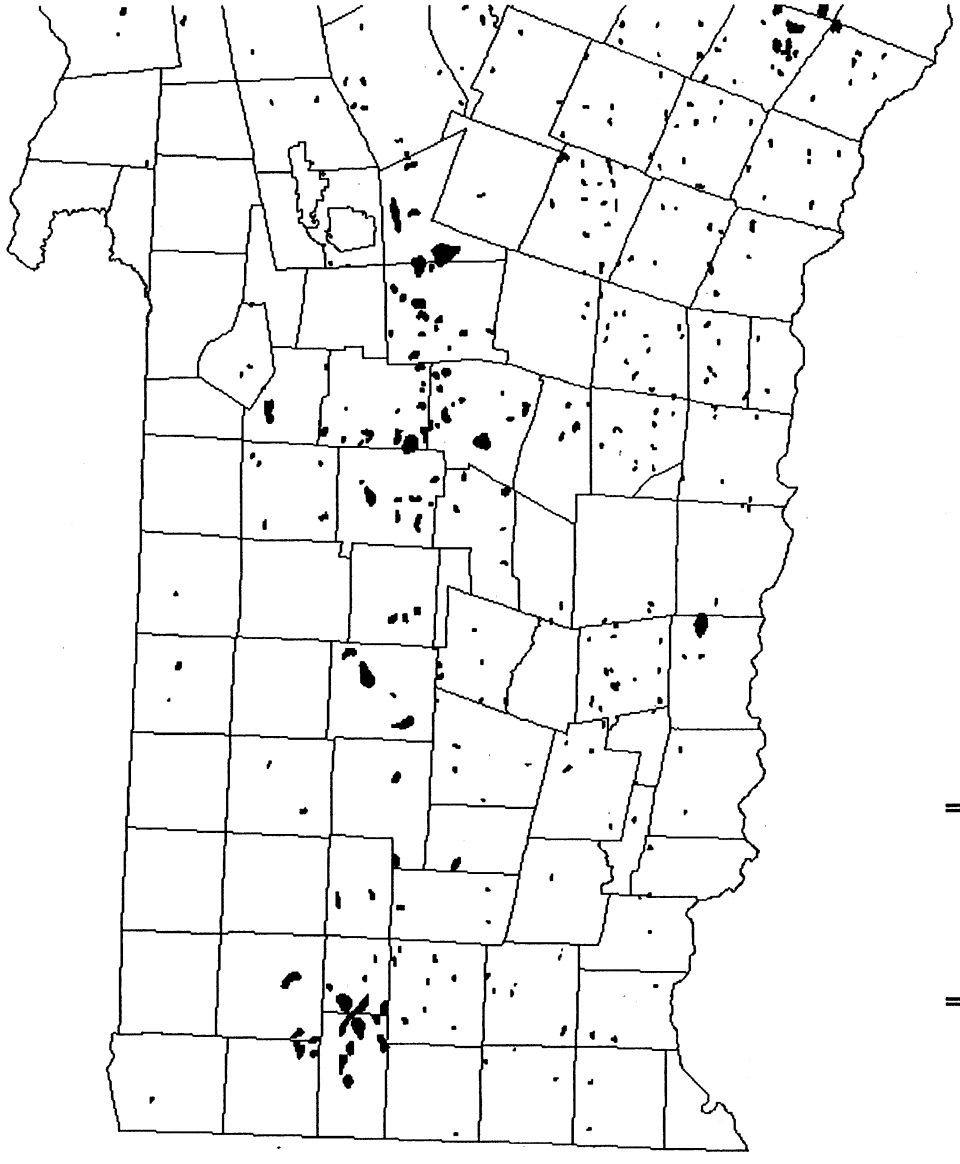


Figure 22. 2000 Hardwood browning and thin crowns due to anthracnose, maple leaf cutter, other defoliators, and heavy seed production. Mapped area is 73,095 acres.

Figure 23. Thin hardwood crowns and foliage browning due to anthracnose, maple leaf cutter, other defoliators, and heavy seed production.

Apple Scab, caused by *Venturia inequalis*, was widespread, beginning early in the season. Severe damage occurred to wild apples, ornamental crabapples, and fruit trees which had not been protected with fungicide. It was difficult to find a crabapple with normal looking leaves, and some did not refoliate successfully. Defoliation of abandoned orchards and other areas was mapped on 206 acres in Addison County.

Rhizosphaera Needlecast, caused by *Rhizosphaera kalkhoffi*, was widely scattered on red spruce regeneration in southern Vermont. One-year old needles were cast in June. On ornamental spruce, needlecast severity increased statewide. Casting of older needles left some trees with thin foliage or dead shoots and branches in the lower crown. Species affected included blue, white, and Norway spruce. Fruiting bodies could be found on green, current-year needles in late fall, indicating that additional needlecast will occur in 2001.

Septoria Leafspot on sugar maple, caused by *Septoria aceris*, was unusually heavy, at much higher levels than have been noted in any previous year (Figure 24). The leafspots are tiny, but were numerous, and appeared early in the growing season.

Sycamore Anthracnose, caused by *Gnomonia platani*, was unusually severe statewide wherever sycamores are found. Complete blighting of the first flush of foliage was often followed by additional damage to a second flush. However, foliage density generally recovered by early summer.

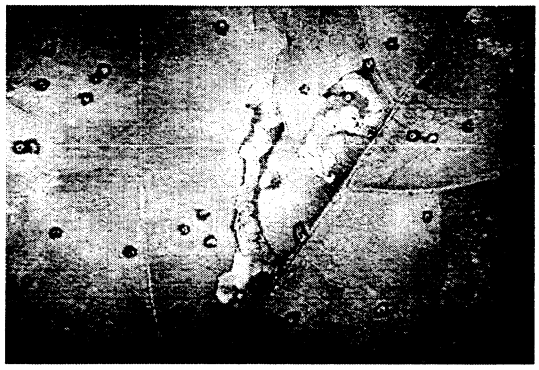


Figure 24. Septoria leafspot on sugar maple foliage, with mining caused by maple leaf cutter larvae.

OTHER FOLIAGE DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Actinopelte Leaf Spot *Actinopelte dryina*	Oak	Brattleboro	Symptoms are similar to anthracnose, but consist of many small lesions which coalesce. Defoliation of lower branches is common.
Alder Leaf Fungus *Species unknown*		Southern Vermont	Heavy defoliation by mid-summer in wetlands.
Anthracnose			See narrative. Additional observations listed below.
Anthracnose *Colletotrichum gloeosporiodes*	Apple	Andover Rockingham Springfield	Disease incidence coincided with apple scab. Symptoms showed up by mid-June.
Anthracnose *Discula errabunda*	Ash	Scattered	Found on landscape trees in Rochester.
Anthracnose *Colletotrichum gloeosporiodes*	Quaking Aspen	Shrewsbury	In wet area.
Anthracnose *Discula umbrinella*	Beech	Widespread	Occasional moderate damage, mostly to regeneration.

OTHER FOLIAGE DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Anthracnose *Discula betulina*	Paper Birch	Throughout	Widespread. Detected during aerial surveys.
Anthracnose *Monostichella robergei*	Hophornbeam	Southern Vermont	Widespread. Detected during aerial surveys.
Anthracnose *Kabatiella apocrypta*	Japanese Maple	Springfield	Lesions limited in size. Did not appear to be causing defoliation.
Anthracnose *Kabatiella apocrypta*	Norway Maple	Rockingham	Ornamental.
Anthracnose *Kabatiella apocrypta*	Red Maple	Scattered	In northern Vermont, more widespread than sugar maple anthracnose.
Anthracnose *Discula sp.*	Sugar Maple	Throughout	Widespread in southern Vermont. In northern Vermont, heaviest in Northeast Kingdom, at higher elevations. Detected during aerial surveys.
Anthracnose *Discula quercina*	Red Oak Chestnut Oak	Scattered	Occasional moderate damage. Appeared early in the season on a white oak in Grand Isle; foliage was blackened and shriveled.
Anthracnose *Gnomonia platani*	Sycamore	Widespread	See narrative: Sycamore Anthracnose.
Apple Scab *Venturia inaequalis*			See narrative.
Ash Leaf Spot *Mycosphaerella fraxinicola*	Ash	North Hero	Damage to landscape trees, more than 50% defoliated.
Aspen Blight *Venturia populina*	Quaking Aspen	Derby	Damage seen on seedlings and saplings causing blackening of foliage and dieback of young twigs.

OTHER FOLIAGE DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Balsam Fir Needlecast *Lirula nervata*	Balsam Fir Fraser Fir	Wolcott	Light infection in one Christmas tree plantation.
Brown Rot *Monilinia fructicola*	Cherries	Scattered throughout	Heavy blighting of shoot growth, especially of scattered pin cherry and ornamental Prunus varieties, in early summer. Symptoms resemble fireblight, but only foliage and fruit are affected. Dieback in Hartland.
Brown Spot Needle Blight *Scirrhia acicola* *Mycosphaerella dearnessii*	White Pine	Bennington Lamoille Counties	Heavy on scattered individual trees that also had heavy damage in 1999, but generally much less common.
Cedar-Apple Rust *Gymnosporangium juniperi-virginianae*			Not observed.
Coccomyces Leaf Spot *Blumeriella jaapii*	Black Cherry	Lamoille	Moderate damage seen.
Cyclaneusma Needlecast (formerly Naemacyclus) *Cyclaneusma minus*	Scots Pine	Throughout	Remains common in Christmas trees but mostly at light levels.
Dothistroma Needle Blight *Dothistroma pini*	Austrian Pine	Bennington Barre	Damage heavy on lower branches.
Entomosporium Leaf Spot *Entomosporium spp.*	Pear	Brattleboro	Tree defoliated except on very top.
Fir Fern Rust *Uredinopsis mirabilis*	Balsam Fir	Widespread	Increasing. More common this year but mostly light damage to Christmas trees.

OTHER FOLIAGE DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Frogeye Leafspot *Botryosphaeria obtusa*	Apple	Waterville	Causing distinct lesions on foliage.
Giant Tar Spot *Rhytisma sp.*	Norway Maple	Springfield Brattleboro	Heavy defoliation of ornamental and naturalized trees by mid-summer. Most severe in sites with poor air drainage.
Horsechestnut Leaf Blotch *Guignardia aesculi*	Horsechestnut	Manchester	Ornamental.
Lilac Blight *Pseudomonas syringae*	Lilac	Lamoille County	Ornamentals.
Lophodermium Needlecast *Lophodermium seditiosum*	Scots Pine	Scattered	Decreasing. Observed in only one Christmas tree plantation. Damage to ornamentals observed in Windsor and Rutland Counties.
Oak Leaf Blister *Taphrina caerulescens*	Oak	Scattered throughout	Heavy damage due to early spring rains at the time of leaf infections.
Phyllosticta Leaf Spot *Phyllosticta spp.*	Mountain Ash Red Maple	Springfield Hyde Park Brattleboro	Ornamental. Rounded lesions on foliage.
Poplar Leaf Blight *Marssonina spp.*	Aspen Poplar	Widespread	Moderate levels. 325 acres mapped, mostly in Orleans County.
Poplar Leaf Bronzing *Virus or virus-like agent*	Balsam Poplar	Northeast Kingdom	Moderate levels.
Powdery Mildew *Eryiphaceae*	Lilac Phlox Hollyhock Petunia	Widespread	Very common this year.

OTHER FOLIAGE DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Powdery Mildew *Mycrosphaera penicillata*	White Lights Azalea	Springfield	This variety is very susceptible to powdery mildew.
Rhabdocline Needlecast *Rhabdocline pseudotsugae*	Douglas Fir	Widely scattered	Stable at light to moderate levels on Christmas trees in northern Vermont. In southern Vermont, needlecast common on unsprayed trees.
Rhizosphaera Needlecast of Spruce *Rhizosphaera kalkhoffii*			See narrative.
Rhizosphaera Needle Blight *Rhizosphaera pini*	Balsam Fir	Reading Ludlow	Moderate damage.
Rhododendron *Unknown species*	Rhododendron	Waterbury	Ornamental.
Septoria Leaf Spot *Septoria aceris*			See narrative.
Septoria Leaf Blight *Septoria betulae*	Paper Birch	Widespread	Mostly moderate defoliation by late summer. Along with anthracnose, principal agent responsible for brown birch mapped during aerial surveys. See Hardwood Defoliators.
Spruce Needle Rust *Chrysomyxa weirii*	Blue Spruce	Hartland Springfield	Reddish-orange pustules evident on last year's needles.
Swiss Needlecast *Phaeocryptopus gaeumanni*	Douglas Fir	Widely scattered	Some moderate infection continues, especially in unsprayed Christmas tree plantations.
Sycamore Anthracnose *Gnomonia platani*			See narrative.

OTHER FOLIAGE DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Tar Spots *Rhytisma acerinum* *Rhytisma punctatum* *Rhytisma sp.*	Sugar Maple Red Maple Striped Maple	Widespread	Common this year, especially on red maple. See also Giant Tar Spot.
Walnut Downy Leaf Spot *Microstroma juglandis*	Hickory	Ferrisburgh	Appears as white fuzz on underside of foliage.
White Pine Needle Blight *Canavirgella banfieldii*	White Pine	Widely scattered	Remains common. Light to moderate infection levels in Christmas tree plantations. Fungi were occasionally associated with white pine chlorosis in May. See Diebacks, Declines, and Environmental Diseases.

ROOT DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Annosus Root Rot *Heterobasidion annosum*			Not observed.
Cylindrocarpon Root Rot *Cylindrocarpon sp.*	Fraser Fir	Bennington	Associated with pockets of dying Christmas trees in a poorly drained area.
Phytopthora Root Rot *Phytophthora spp.*			Not observed.
Shoestring Root Rot *Armillaria spp.*	Many	Throughout	Common on stressed trees. Associated with thin Norway spruce crowns in a plantation in Windsor with seasonal high water.

Drought symptoms, incited by water stress during the growing season of 1999, were observed on a variety of species. Decline symptoms were common on disturbed or limiting sites, on recent transplants, and on wounded trees. There was an increase in sightings of bark beetles, and of weakly pathogenic canker fungi, such as *Steganosporium* on sugar maple, and *Caliciopsis* on white pine. Symptoms were observed on scattered northern white cedar in the Champlain valley, and marginal scorch was more common than usual on disturbed sugar maple. Other observations associated with the drought are listed under Ash Dieback, Maple Decline, Hemlock Decline, Spruce Dieback, Wet Site, and White Pine Chlorosis.

Environmental Stress is the focus of research being conducted by a working group of scientists from the USDA Forest Service Northeastern Research Station and The University of Vermont School of Natural Resources. Research on the mechanisms of plant stress response and resistance has focused on how human-induced stress (e.g., acid rain, nitrogen deposition, and climate change) and plant nutrient deficiencies (especially calcium depletion) may interact to increase tree injury susceptibility and decline. Studies also include an evaluation of how environmental stress may alter fall foliage color development. Work on the biological foundations of forest sustainability is assessing how human disruption of fundamental processes like nutrient cycling and within-species genetic diversity may diminish the ability of tree populations to successfully respond to and survive existing and emerging environmental stresses (e.g., pests and pathogens, climate change, pollutant exposures, exotics, etc.). One study is using computer-simulated harvests within a genetically mapped white pine forest to model the possible influence of silvicultural manipulation on the genetic base of that stand.

Hardwood Decline and Mortality symptoms were mapped on 15,180 acres during the aerial survey (Table 12, Figure 25). This is a decrease from the 21,223 acres mapped during the dry growing season of 1999 (Figure 26).

Table 12. Mapped acres of chlorosis, dieback, mortality, and thin crowns on hardwoods in 2000.

COUNTY	ACRES
ADDISON	1,839
BENNINGTON	10,051
CALEDONIA	105
CHITTENDEN	786
FRANKLIN	127
GRAND ISLE	73
ORLEANS	162
RUTLAND	311
WASHINGTON	78
WINDHAM	881
WINDSOR	767
TOTAL	**15,180**

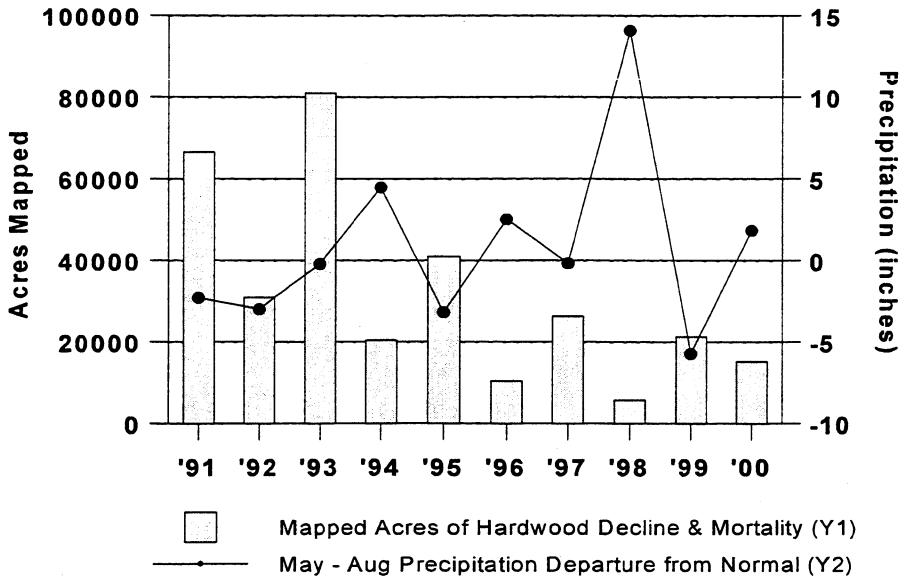
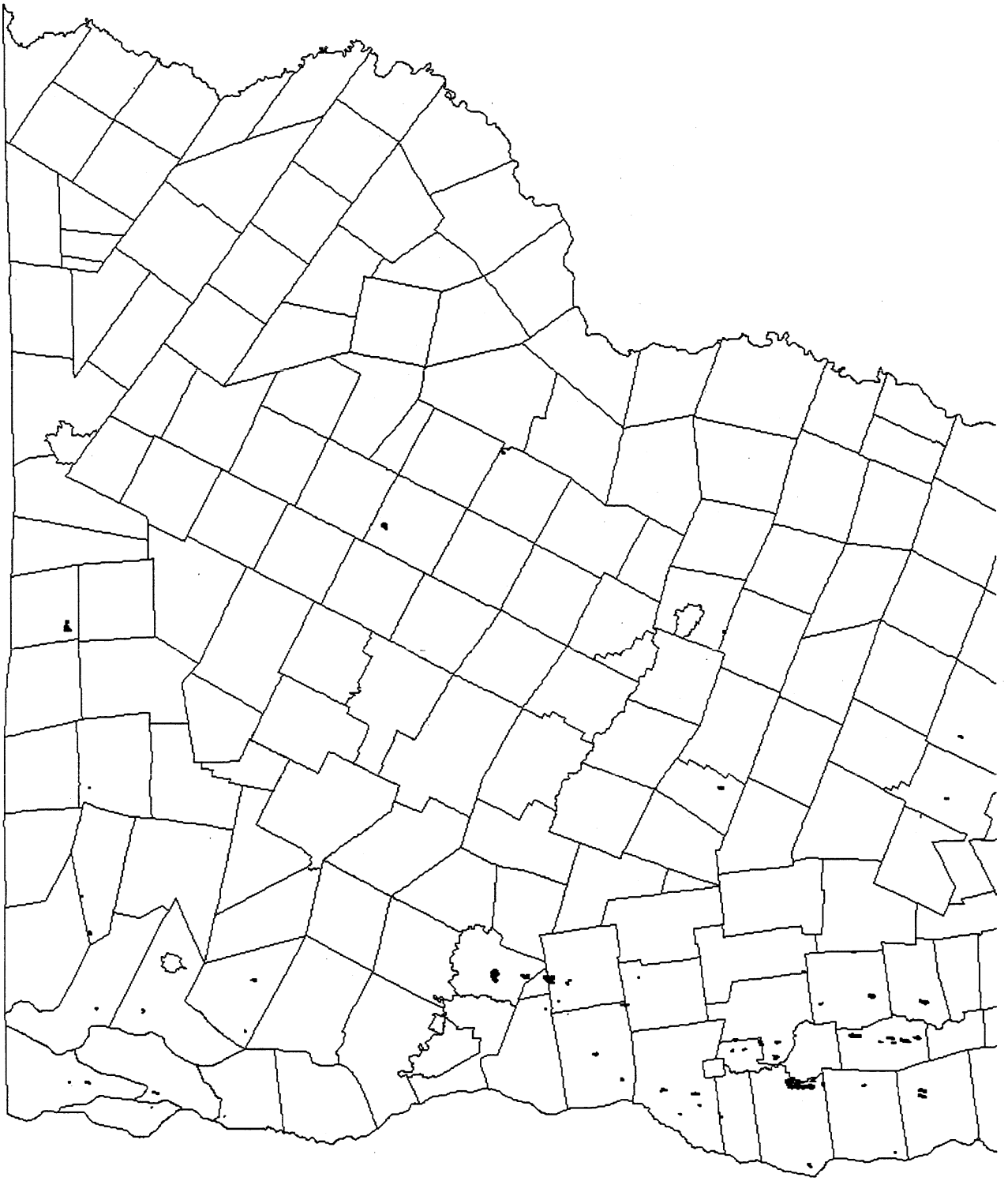


Figure 26. Acres mapped of hardwood decline and mortality mapped during annual aerial survey, compared to growing season precipitation, 1991-2000. Precipitation data from National Weather Service, Burlington.

Heavy Seed production on many species led to thin crowns statewide. Particularly noticeable was a heavy crop of 2nd year cones on white pine, resulting in very thin foliage in the upper crowns (Figure 27). Heavy seed production on red maple was associated with very little foliage in upper crowns into mid-June. Other species with heavy seed, and occasional thin crowns were sugar maple, beech, oak, black walnut, hickory, hophornbeam, linden, mountain maple, spruce, balsam fir, hemlock, and cherry. Thin crowns associated with heavy seed were mapped on 1132 acres, mostly in Essex County.

Hemlock Decline was widely observed in late winter and early spring. Foliage browning and shoot dessication were most common on ledgey, poorly drained, roadside, and disturbed sites. Warm, dry weather in the early winter may have contributed to symptoms (Figure 28). Hemlock borer was sometimes associated with symptomatic trees. Some heavily infested trees still had green foliage in late spring.



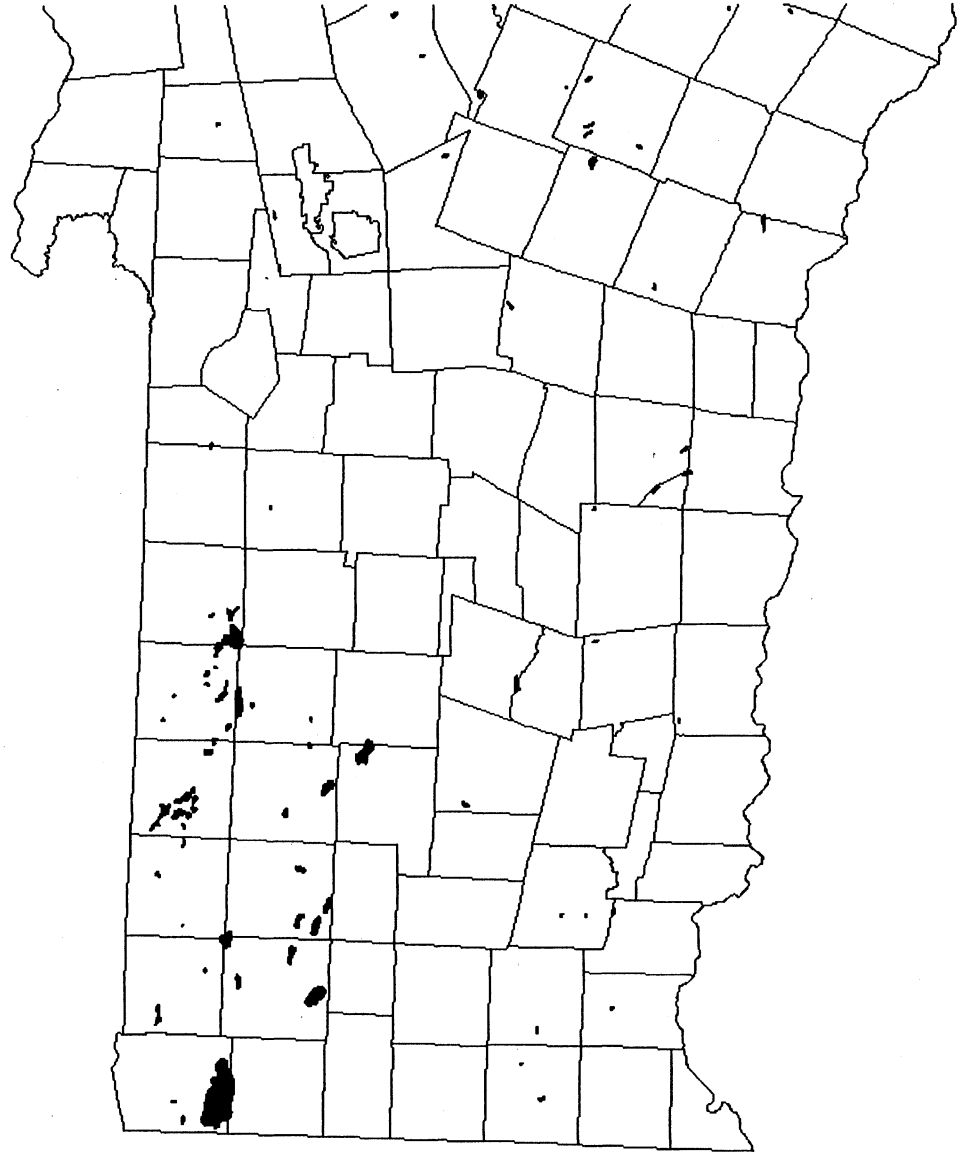


Figure 25. 2000 Hardwood thin crowns, chlorosis, mortality and dieback. Mapped area is 15,180 acres.

Figure 27. Thin crowns associated with heavy cone production on eastern white pine.

Ice Storm Damage from the January 1998 storm continues to be visible throughout the affected area. Some additional mortality, mostly of paper birch, was observed in 2000. However, many broken trees are continuing to recover as foliage and branches fill in crown gaps. Abundant moisture contributed to greater foliage density and better leaf color in damaged stands.

Monitoring continues on North American Maple Project plots (see Trends in Forest Condition). Seven of the 40 plots were affected by ice loads. Although initial damage was significant at some sites, trees are showing signs of recovery. There has been a slight improvement in crown dieback and tree vigor, while foliage transparency continues to fluctuate around 20% (Figure 29). On five of the seven sites, the percent of trees which were healthy (≤15% dieback) in 2000 was at least as high as prior to the ice storm (Figure 30). The condition of ice-damaged sugar maples continues to improve, especially trees that sustained moderate to heavy injury (Figure 31).

Regeneration has been measured on 5 sub-plots at each North American Maple Project plot for the past three years to help assess forest changes due to the 1998 ice storm. Sugar maple regeneration has increased in ice-damaged plots, as seedlings and saplings respond to increased light due to canopy gaps (Figure 32). The number of seedlings in ice-damaged plots has remained high over the last 3 years, at 25 seedlings per milacre sub-plot, while the abundance of seedlings on other North American Maple Project plots has continued to decrease to 15 per sub-plot. While no significant trend in sapling abundance has occurred over the past 3 years, ice-damaged stands continue to have more saplings than non-ice damaged plots.

Results from Vertical Canopy Photography plots are reported in the appendix. In this study, all except the three upper elevation stands showed a significant increase in percent canopy cover from 1999 to 2000. This ranged from 6%, for a very lightly damaged stand, to 19% for a heavily damaged stand.

In an incidental monitoring plot in Plymouth, ten of the twenty trees had over 75% breakage. Of these trees, four have died. The remaining six average 70% of the live crown in epicormic shoots, compared to 20% for the ten trees with less than 75% crown breakage. Trees with only light breakage which increased in dieback between 1999 and 2000 (Figure 33) were those which were bent and uprooted by the storm.

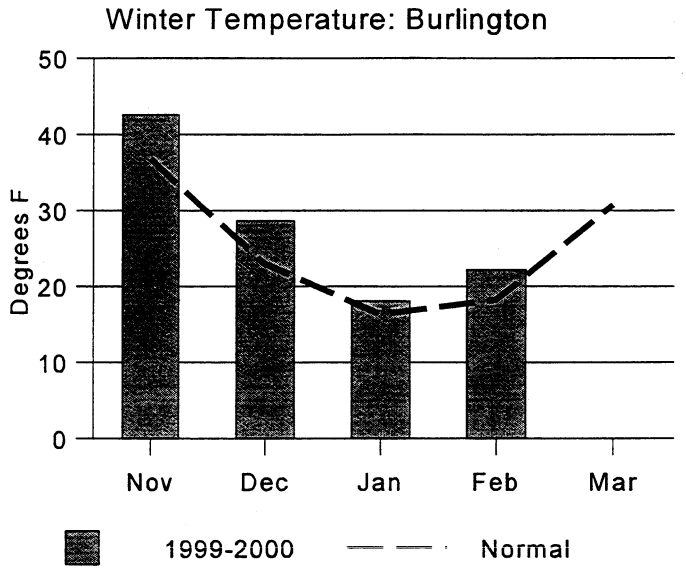
A brochure, *A Guide to Life in Storm Damaged Trees*, was completed. The teaching kit, *Forest Insect Discovery Program: The Small-sized Big Players of Forest Ecology*, is now available, and contains a unit on insects which occur in forest stands following ice damage.

Spruce-Fir Mortality and Dieback was mapped on 3,545 acres this year, with the most damage visible in Orleans County (Table 13). Acreage is similar to 1999, when 3,479 acres were mapped.

Defoliation and dieback of red spruce regeneration were frequently observed in the southeastern Green Mountains in the spring. In some stands, the damage was moderate to severe, including dead trees, with lighter damage occurring elsewhere. Dead shoots could be found anywhere in the crown, although more likely towards the top. The damage occurred in patches in affected stands. *Rhizosphaera* was found on some needles, however, its fruiting bodies were uncommon. Overstory red spruce had no symptoms. Roots of young red spruce are known to be concentrated in the upper 6" of soil, making them vulnerable to the '99 drought. *Rhizosphaera* infection may have further reduced water movement through shoots.

Wet Site conditions caused more widespread damage than normal. Wet previous growing seasons had resulted in super-saturated conditions which suffocated all but the uppermost roots. This was followed by poor water availability in 1999, and high water levels in 2000. White pine and hemlock decline were particularly noticeable. In all, 10,194 acres were mapped during aerial surveys (Table 14). Pockets of balsam and fraser fir Christmas tree mortality were observed in scattered locations on poorly drained sites.

White Pine Needle Chlorosis was observed on white pine in scattered locations statewide. Chlorotic foliage and casting of previous year's needles were widespread by early June. Fungi were rarely associated with the fallen needles. Most symptomatic trees were along roadsides or in wet areas, although on a particular site, not all trees were symptomatic. Symptoms were thought to have been incited by the '99 drought, but other abiotic causes, such as nitrogen deficiency or pollution injury have not been ruled out.



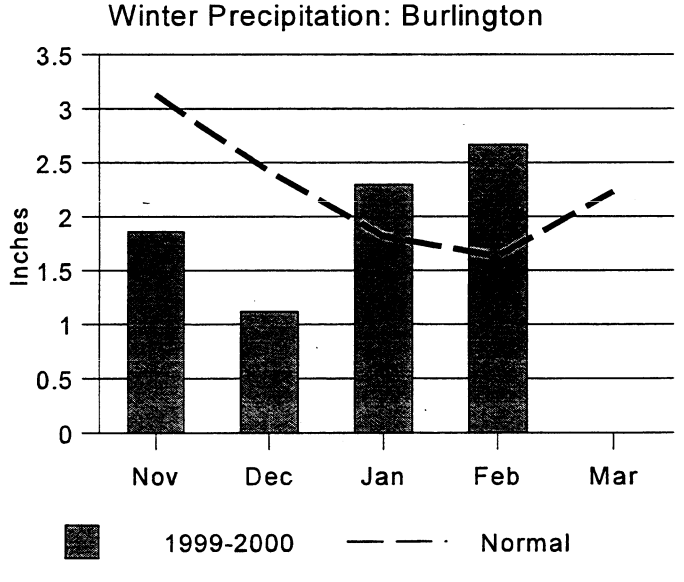


Figure 28. Winter temperature (in degrees F) and precipitation (inches) in the winter 1999-2000, compared to normal, at Burlington. Data from NOAA National Weather Service.

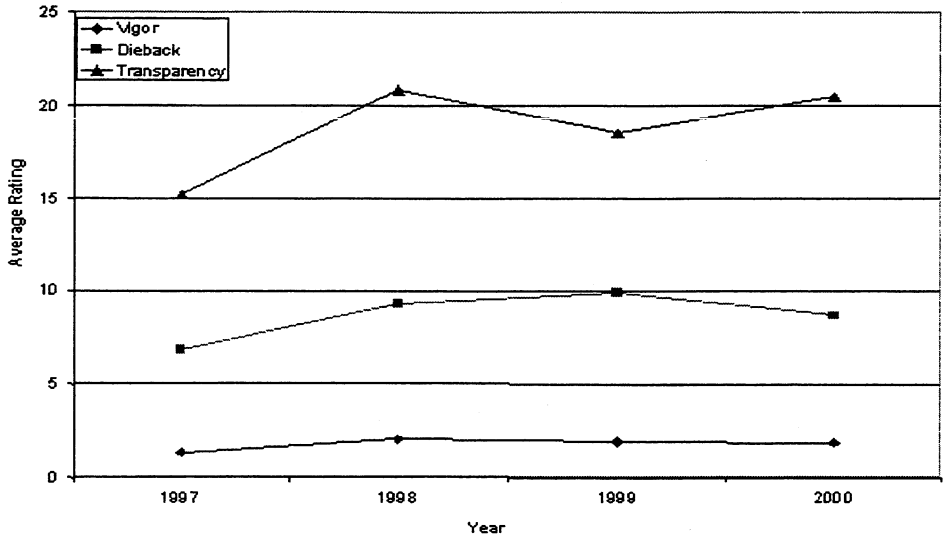


Figure 29. Average vigor rating, % crown dieback, and % foliage transparency of all tree species of the seven North American Maple Project plots in Vermont injured by the 1998 ice storm. Vigor rated on a 1 (healthy) to 5 (dead scale).

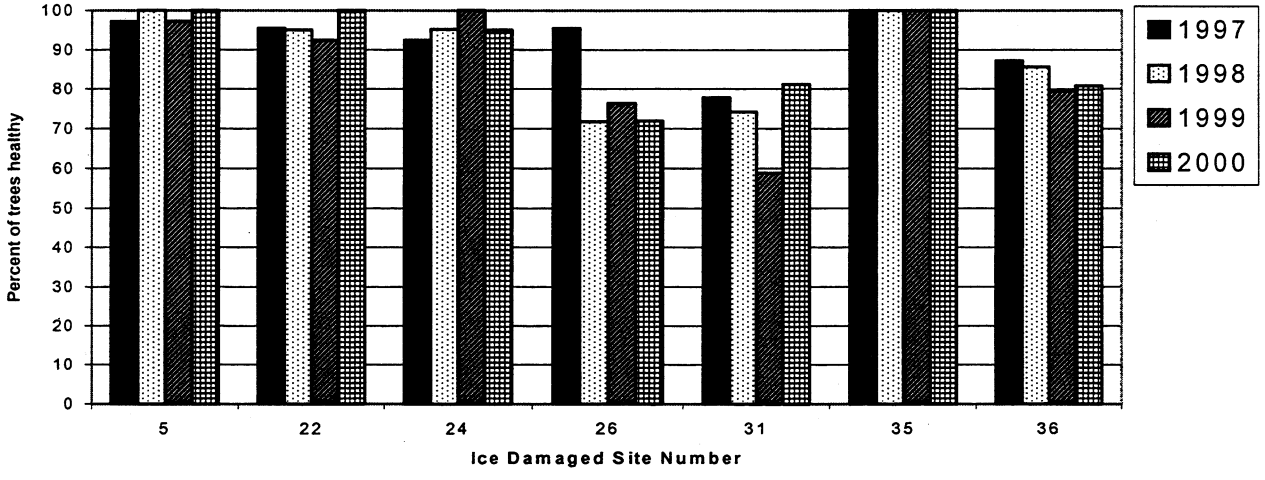


Figure 30. Percent of healthy trees at each of the North American Maple Project plots affected by the 1998 ice storm. Includes all species and crown classes, 1997-2000.

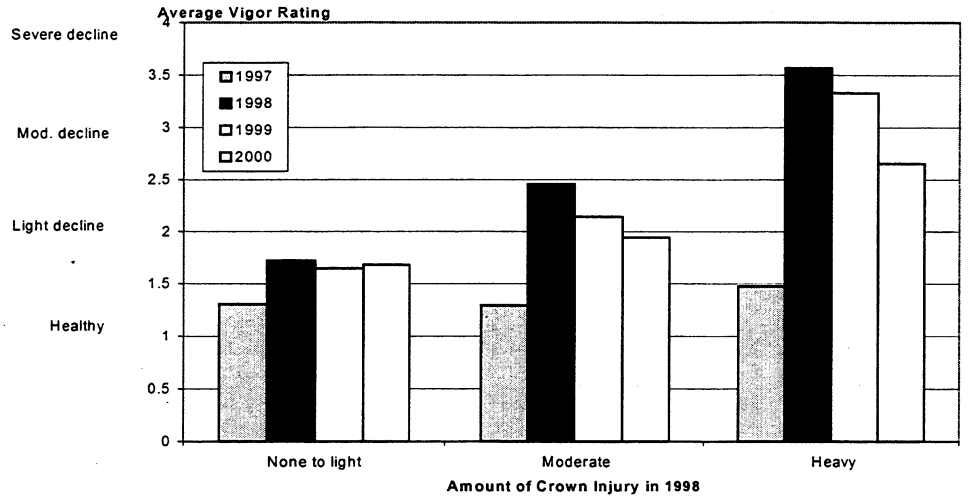


Figure 31. Average vigor rating of sugar maple trees, from the seven North American Maple Project plots affected by the 1998 ice storm, grouped by amount of initial injury from the storm. Data from 1998-2000.

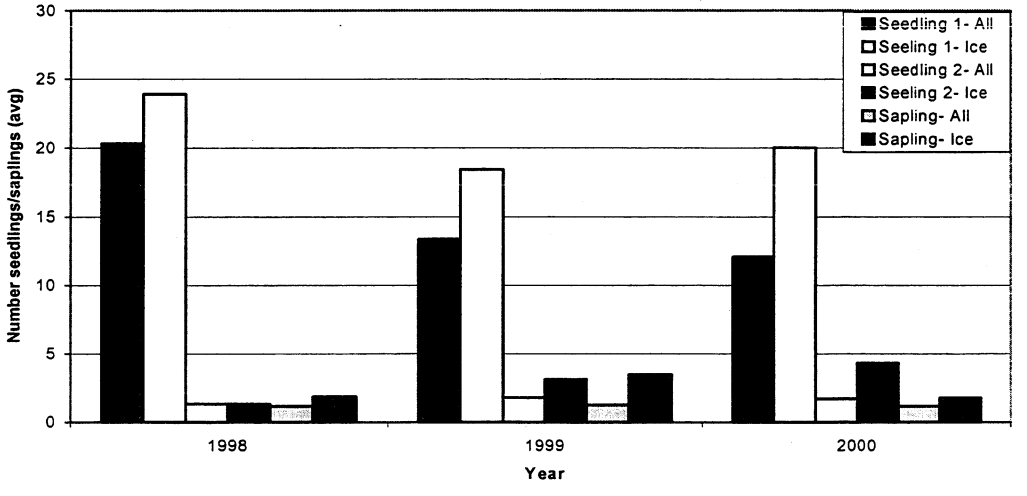


Figure 32. Number of sugar maple seedlings and saplings per milacre subplot on all North American Maple Project plots in Vermont, compared with stocking in the seven plots damaged by the 1998 ice storm, 1998-2000. Seedlings in Class 1 are <30 cm tall, and have more than 2 leaves. Seedlings in Class 2 are >30cm to <1 meter tall, and saplings are >1 meter tall, to <10 cm DBH.

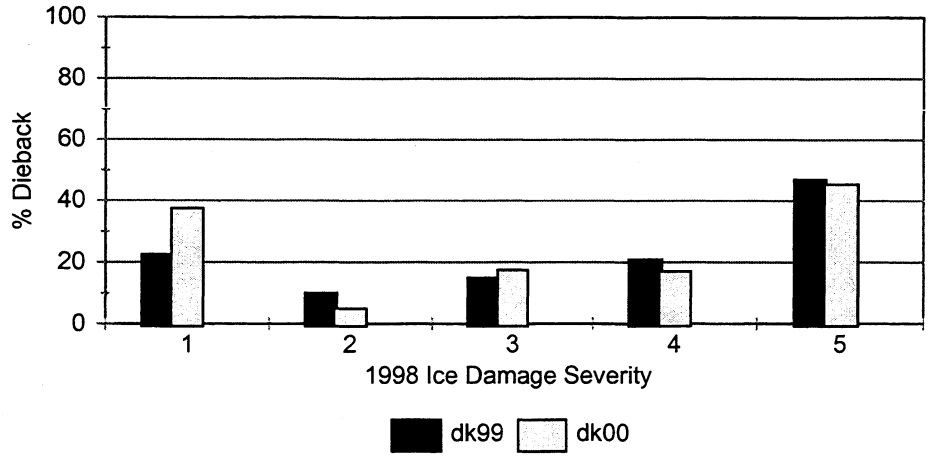


Figure 33. Dieback in ice damage monitoring plot in Plymouth, 1999-2000, by 1998 ice damage breakage severity (1= 0-10%[2 trees], 2=11-25% [1 tree], 3=26-50% [2 trees], 4=51-75% [5 trees], 5=76-100% [10 trees]).

Table 13. Mapped acres of spruce-fir mortality and dieback in 2000.

COUNTY	ACRES
ADDISON	285
BENNINGTON	303
CALEDONIA	43
CHITTENDEN	23
ESSEX	407
FRANKLIN	310
GRAND ISLE	4
ORANGE	183
ORLEANS	1,123
RUTLAND	505
WASHINGTON	34
WINDHAM	109
WINDSOR	216
TOTAL	**3,545**

Table 14. Mapped acres of dieback and mortality associated with wet site conditions in 2000.

COUNTY	ACRES
ADDISON	2,883
BENNINGTON	179
CALEDONIA	4
CHITTENDEN	883
ESSEX	13
FRANKLIN	2,185
GRAND ISLE	2,724
LAMOILLE	16
ORLEANS	284
RUTLAND	714
WASHINGTON	7
WINDHAM	188
WINDSOR	114
TOTAL	**10,194**

OTHER DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Ash Defoliation	White Ash	Jamaica Winhall	No symptoms were observed on white ash in stands which had been defoliated in 1997 by unknown cause. An evaluation study of this damage suggested that symptoms were related to poor water availability caused by dry weather in June, shallow soils, exposed sites, and tree wounding where ash was near the edge of its range.
Ash Dieback	White Ash	Southern Vermont	More commonly observed than normal on shallow sites with intermittent water availability. The 1999 drought may have incited the development of decline symptoms. See also Ash Yellows.

OTHER DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Birch Decline	Paper Birch	Scattered	Not mapped this year, though bent birch was noted in old ice-damaged areas.
Delayed Chlorophyll Development	Red Maple Sugar Maple	High elevations	Symptoms attributed to late spring phenology, cool temperatures, and limited amount of sunshine in late spring.
Drought			See narrative.
Edema	Apples	Springfield	Swelling on stems of nursery trees apparently related to warm soil, ample moisture and cloudy, humid days. Trees took up water, but did not transpire.
Fading Out	Balsam Fir	Reading	Interior needle drop in the fall attributed to impact of '99 drought on a tree growing on ledge.
	White Pine	Throughout	See White Pine Needle Chlorosis.
Fertilizer Injury			Not observed.
Frost Damage	Balsam Fir White Spruce Red Spruce	Northern Vermont	Widely scattered light damage to balsam fir and white spruce Christmas trees in most plantations surveyed. Upper elevation damage to red spruce in the Northeast Kingdom.
Hail Damage	Blueberry	Lincoln	Damage to blueberry fruit was noticed some time after a hail storm.
Hardwood Decline and Mortality			See narrative.
Heavy Seed			See narrative.
Hemlock Decline			See narrative.
Ice Storm Damage			See narrative.

OTHER DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
Improper Planting	Many	Throughout	Girdling roots, trees with inadequate root systems, burlap wraps left on root balls, and trees planted too deep were often the cause of dieback or mortality.
Larch Decline	Eastern Larch	Northeast Kingdom Rutland County	Many new trees yellowing this year following the 1999 drought. 252 acres mapped. Continues in areas with recent larch casebearer defoliation.
Logging Related Decline		Widely scattered	381 acres mapped during aerial survey.
Maple Decline	Sugar Maple		See Hardwood Decline and Mortality.
Mechanical Injury	Many	Throughout	Widespread cause of tree decline. Symptoms exacerbated by '99 drought.
Ozone Injury	Blackberry	Sunderland	Damage levels generally lower in monitoring plots.
Pesticide Injury	Norway Spruce Sugar Maple	Brattleboro Middletown Springs	Dieback associated with the use of lawn herbicides.
Salt Damage	White Pine Red Pine	Throughout	Foliar damage from airborne salt common in northern Vermont.
Shoot Fasciation	White Spruce	Weathersfield	Ornamental. Associated symptoms are defoliation, stunting, and dieback. Damage has been occurring over a number of years throughout the crown.
Spruce/Fir Mortality and Dieback			See narrative.
Wet Site			See narrative.

OTHER DIEBACKS, DECLINES, AND ENVIRONMENTAL DISEASES			
DISEASE	**HOST(S)**	**LOCALITY**	**REMARKS**
White Pine Dieback	White Pine	Putney Scattered	Pockets of mortality in woodland. No causal organisms were identified. Pockets of mortality on ledgy or wet sites.
White Pine Needle Chlorosis			See narrative.
Wind Damage	Many	Widely scattered	Heavy in small areas, especially northern Franklin County and Groton. 440 acres mapped. Wind storm on 12/18 caused uprooting of exposed white pine in Windham County.
Winterburn	Conifers	Throughout	Very little winterburn reported.

ANIMAL DAMAGE			
ANIMAL	**SPECIES DAMAGED**	**LOCALITY**	**REMARKS**
Beaver	Many	Throughout	Numbers remain high. Widespread damage from flooding and feeding. Decreasing in Route 7 Valley in Bennington County.
Deer	Sugar Maple White Ash Other Hardwoods Red Oak	Widely scattered	Heavy browse pressure, invasive exotic plants, and fern invasion prevent adequate regeneration in many areas in southern Vermont, especially in the lower Connecticut River Valley. Heavy feeding on new oak growth in May. Complaints from several apple growers in the Northeast Kingdom.
Moose	Many	Widely scattered	Stripping of bark in winter becoming more common. Damage heaviest to red maple and striped maple in the Northeast Kingdom.
Mouse	Many	Newport	Damage common.
Pileated Woodpecker	Hemlock White Pine	Chittenden County	Numerous calls on stressed trees being worked by these woodpeckers following invasion by bark beetles.
Porcupine	Many	Widely scattered	Populations increasing from recent years. Animals and their damage observed occasionally.
Sapsucker	Many	Widespread	Damage common. Severe damage to scattered ornamentals.

ANIMAL DAMAGE			
ANIMAL	**SPECIES DAMAGED**	**LOCALITY**	**REMARKS**
Squirrel	Conifer	Widespread	High squirrel populations led to widespread shoot clipping in winter 99-00. The low availability of mast led them to feed heavily on conifer buds. Clipping was frequently so heavy that the ground was carpeted with green shoots. Damage was heaviest to Norway spruce, and also heavy on hemlock, spruce, and fir. There was less damage to pine. Although populations were down by fall in some areas, they remained high elsewhere.
	Red Oak	Southern Vermont	Green leaves clipped off trees in late summer by squirrels feeding on acorns.

INVASIVE PLANTS

The **Vermont Non-game and Natural Heritage Program** reports that not much has happened on the exotics issue this past year except for their continued spread throughout the state. With few exceptions, the extent of the problem on state lands has not yet been systematically documented, but this may soon change. Two new initiatives are about to begin: one which could limit new infestations and the other with more direct impacts.

The Agriculture Department, with input from the Agency of Natural Resources, has drafted a **Noxious Weed Quarantine** under the authority of the Pest Survey, Detection and Management Statute (6 VSA, Chapter 84). The rule, as currently proposed, lists 33 plant species restricted from sale or import into the state. Although most already occur in Vermont, the intent is to prevent their further spread, especially into areas of the state where they do not yet occur or present a problem. Nearly half (15 species) are true aquatics that grow only in permanently flooded environments, including notorious offenders such as Eurasian watermilfoil and water chestnut. The remainder are evenly divided between woody and herbaceous species. The woodies include five species of exotic honeysuckles and both European and glossy buckthorns, some of the more disreputable members of our introduced flora. The herbaceous category includes mostly wetland species such as purple loosestrife, common reed, and flowering rush, but also includes invasives occurring in more terrestrial or at least seasonally dry habitats. Japanese knotweed, garlic mustard, goutweed, and swallow-wort head the least wanted list in this category.

The second initiative is led by **The New England Plant Conservation Program** (NEPCoP), a network of agencies and organizations under the auspices of the New England Wildflower Society. NEPCoP enlists a cadre of skilled volunteers to monitor rare plants in each of the New England states. Last year the program branched out to undertake invasive surveys on protected lands in Massachusetts and Rhode Island. Volunteers there have begun some management actions to remove exotics on protected lands with state listed plants. There is some interest in beginning at least an exotics monitoring program here in Vermont in the future. Ideally, utilizing volunteers, we could begin to document the extent of the problem on state lands and begin some limited management to assess the likelihood of control.

FOREX, Vermont's comprehensive forest resource inventory system, has been recently revised, and includes opportunities to record the presence of invasive exotic species and other potential causes of regeneration failure.

Data from the **US Forest Service 1997 Forest Inventory** show that 1.4% of seedlings, saplings, and shrubs statewide consist of barberry, honeysuckle, buckthorn, and prickly ash (Figure 34). Each of these genera includes invasive, exotic species.

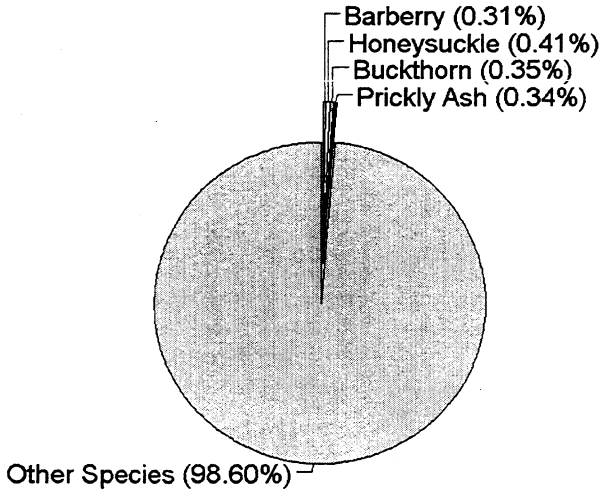


Figure 34. Proportion of seedlings, saplings, and shrubs identified as barberry, honeysuckle, buckthorn, or prickly ash species, compared to the total number of seedlings, saplings, and shrubs tallied as part of the US Forest Service Forest Inventory and Analysis survey in Vermont, 1997.

TRENDS IN FOREST CONDITION

Introduction

This information on forest condition is from North American Maple Project plots in Vermont. Four indicators of tree condition have been used to determine trends over the last 13 years: tree vigor, crown dieback, foliage transparency, and mortality. Low values for all these indicators show good or improving tree condition. In the North American Maple Project, 5 tree species are represented in sufficiently large numbers to monitor over time: sugar maple, beech, yellow birch, white ash, and red maple. In addition to information on current condition of trees, data is collected on injuries to trees that might affect their long-term health (e.g. insect defoliation, ice storm damage).

Sugar Maple Condition

Sugar maple health remained similar to recent years with 92.5% of overstory trees in a healthy condition (≤15% dieback). Foliage transparency has generally been increasing since 1998 (Figure 35). Mortality remains at 1.4 with some trees dying as a result of the 1998 ice storm, and others affected by the 1999 drought. Dieback remains low, and vigor remains stable, with most trees rated as healthy.

Wet spring conditions led to considerable browning from leaf diseases. In addition, heavy seed was recorded on 25% of North American Maple Project plots. These factors both contributed to thinner foliage and higher foliage transparency ratings.

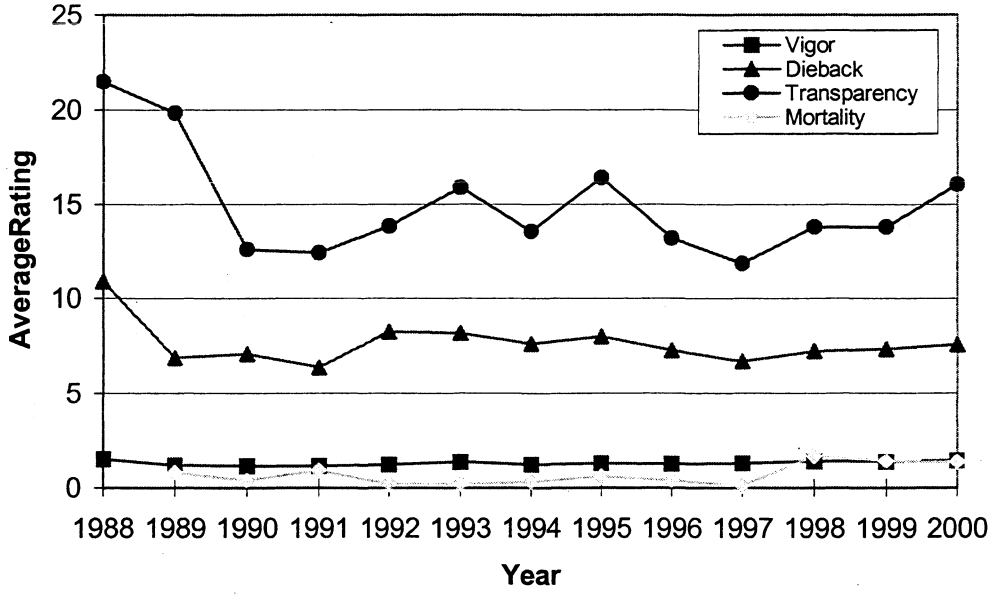


Figure 35. Trend in overstory sugar maple condition on North American Maple Project plots, 1988-2000.

Other Hardwood Species

Red maple and white ash health remained fairly constant in 2000, with a slight increase in foliage transparency of red maple, and a slight decrease in dieback of white ash (Figures 36-37). Yellow birch and beech both had high foliage transparency ratings, 22 and 26% respectively, the highest recorded for each species during this 13 year survey (Figures 38-39). Beech also continues to have dieback ratings greater than 10%, higher than any other species.

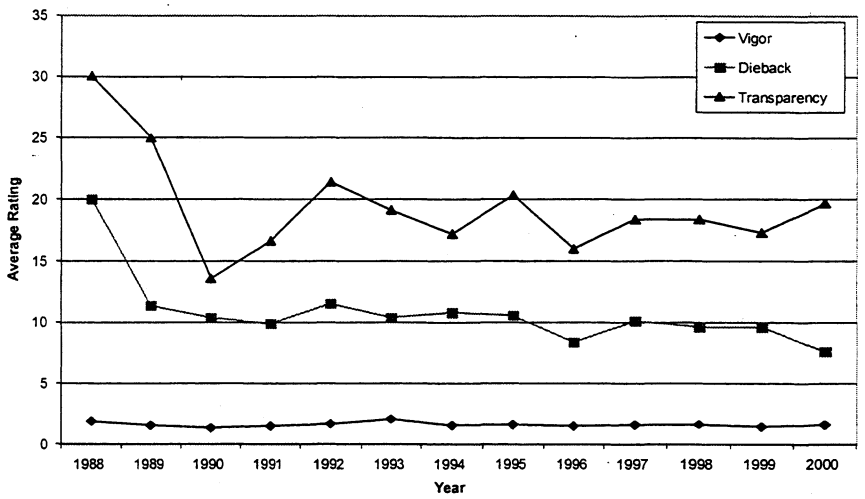


Figure 36. Trend in the condition of red maple trees on North American Maple Project plots in Vermont, 1988-2000.

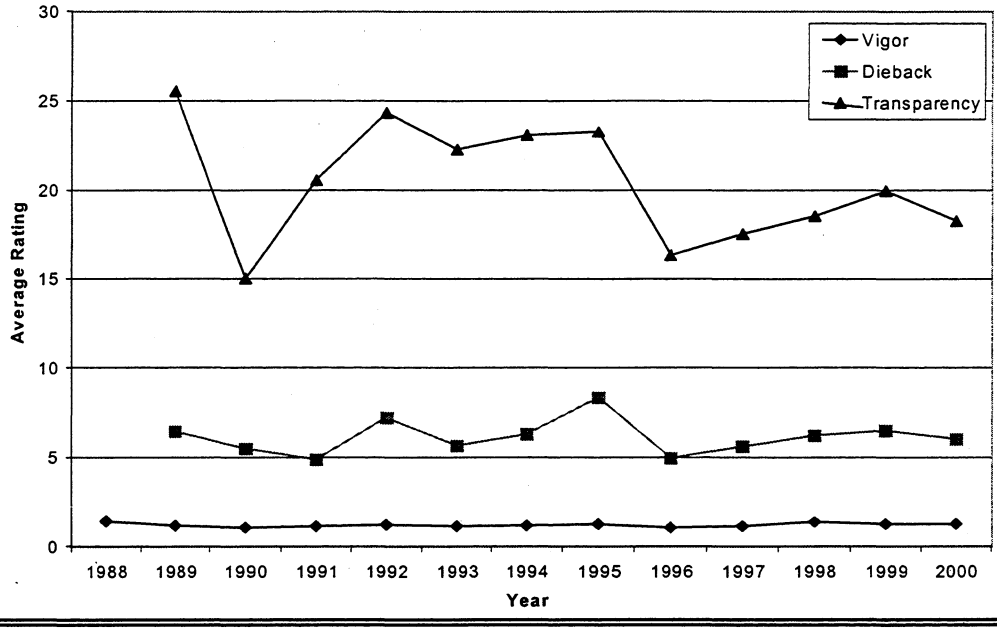


Figure 37. Trend in the condition of white ash trees on North American Maple Project plots in Vermont, 1988-2000.

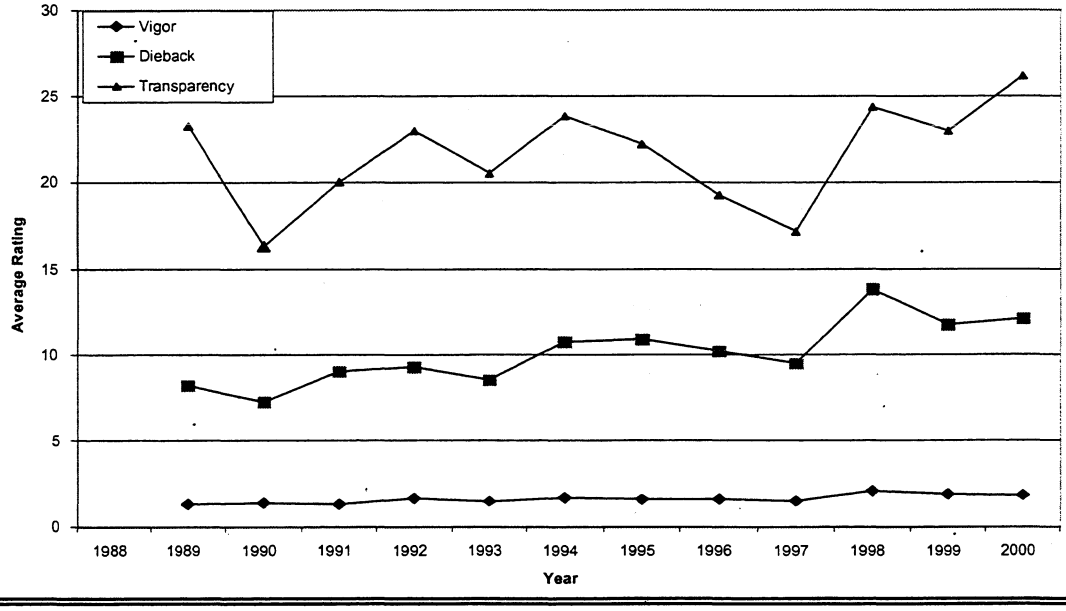


Figure 38. Trend in the condition of beech trees on North American Maple Project plots in Vermont, 1988-2000.

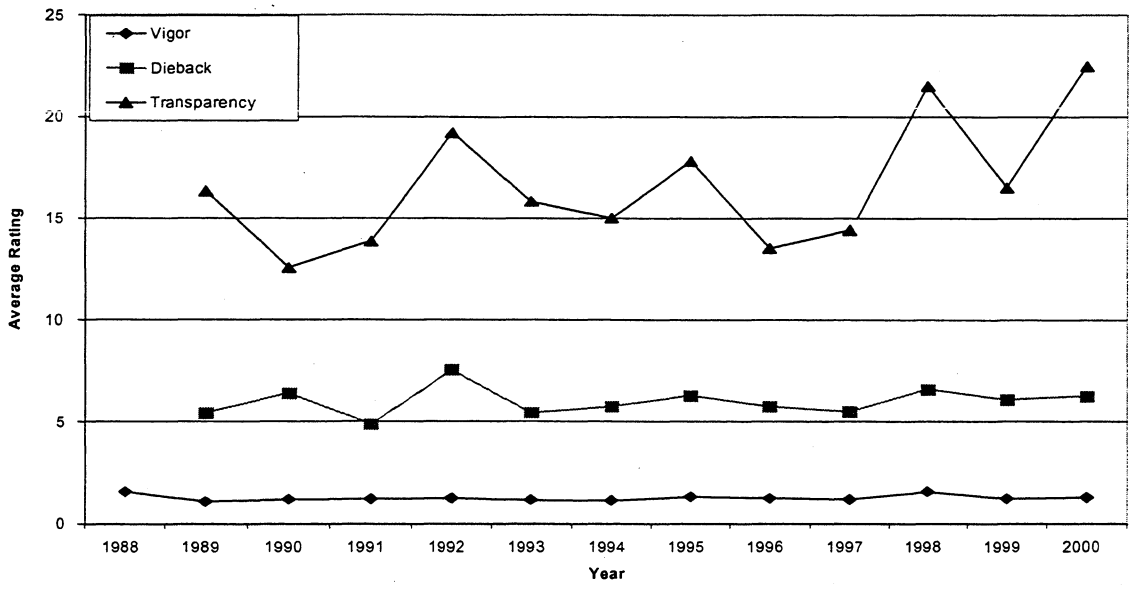
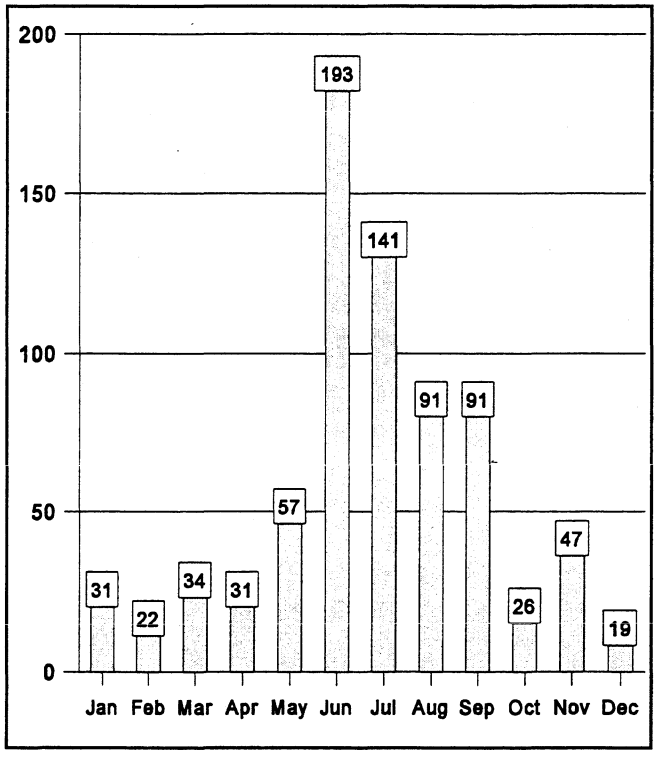


Figure 39. Trend in the condition of yellow birch trees on North American Maple Project plots in Vermont, 1988-2000.

FOREST BIOLOGY LABORATORY - 2000

Laboratory Diagnostic Services

Requests to the Forest Biology Laboratory for identification and diagnosis of tree insect and diseases, control recommendations and other information increased from 678 in 1999 to 783 in the year 2000. Inquiries were highest in June (193) and July (141) (Figure 1).



The majority of the 495 requests for identifications involved insects and diseases associated with trees and shrubs (74%), but we also diagnosed insects and diseases associated with residences (9%), plants other than trees (4%), and other miscellaneous situations. Concerns involving arthropod pests of humans or animals made up 4%. Insects collected "at large", with no host associated with the insect at the time of observation, made up 5% of the requests, and 2% of the insects were found in aquatic sites, soil or snow. Insects associated with wood products made up 1% of the requests for identification and predators and parasites made up the final 1%.

We received inquiries from all counties in Vermont (Figure 2). The highest number came from people in Washington County (144) and the fewest from Essex County (9). We had 65 out-of-state inquiries, and seven requests that involved state-wide observations.

County	Number of Requests
Addison	63
Bennington	14
Caledonia	45
Chittenden	113
Essex	9
Franklin	24
Grand Isle	21
Lamoille	46
Orange	27
Orleans	18
Rutland	41
Washington	144
Windham	44
Windsor	87
Out of State	65
Statewide	7
Southern Vermont	1
Northeast Vermont	2
Location not given	12
Total	**783**

Types of Information Requested

Of the 783 inquiries received at the Forest Biology Lab in 2000, 63% (495) involved identification of insects and diseases, while 28% (220) were specifically for information, such as biology and management. Seven per cent (51) needed reference material, slides, photos, specimens or equipment. About 1% (7) of our calls were for plant identifications and another 1% (10) were from people who wanted to give or receive information about tree health conditions and the status of particular insects or diseases in Vermont.

User Groups

The majority of requests in 2000 (59%) came from the general public, either directly or through FPR personnel. Numbering 464, these involved a large variety of insects and diseases, mostly from trees and shrubs, but occasionally from herbaceous plants, wood products, and other hosts. Sixteen percent (125) of the inquiries came from county foresters and other state and federal forestry personnel, and 7% (56) from sugarbush operators, nurseries and garden centers, and other members of the "Green Industry." Educators, including teachers, naturalists, and others, made up 9% of the inquiries (69). Three percent (21) came from Christmas tree growers, and 2% (12) from pest control operators involved with insects in buildings. Two percent (15) of our inquiries came from other laboratories, and 1% came from the news media (10). Physicians, veterinarians, politicians, wildlife biologists and people from other assorted groups (11 inquiries) made up the final 1%

Host Types

About two-thirds of the inquiries received in the year 2000 involved trees. Forty-five percent of the specimens submitted to the lab for identification came directly from trees, and another 20% of the specimens were known to feed on trees but were collected "at large." This category included the white-spotted and northeastern sawyer, which we know are associated with dead and dying conifers, though the beetles were not collected from these host trees. We received inquiries that involved a total of 61 species of hardwood and softwood hosts.

For tree inquiries where insects or disease were associated directly with trees, sugar maple (18%), apple (9%), spruce (8%) (half of these were Colorado blue spruce), balsam fir (7%), eastern white pine (6%), hemlock (5%), and cedar (3%) were most commonly involved.

The other 30% or so of the inquiries regarded insects found in households and buildings (both as structural pests and as inhabitants of stored products), on humans or animals, in soil or snow, in flower or vegetable gardens, or in aquatic settings. We received several inquiries about insect parasites and predators.

Laboratory Products

Two new products are available from the Forest Biology Lab. The first is an instructional kit, *Forest Insect Discovery Program: The Small-Sized Big Players of Forest Ecology* (ISBN 0-9700823-0-4) by Trish Hanson and Jessica Rykken. This kit was designed to be taken into the classroom by a natural resources professional or used by a teacher for an introductory session in forest entomology. It contains all the materials needed for a number of indoor and outdoor activities. Although we have targeted 4-6 graders in developing these materials, they are appropriate for a wider range of ages and abilities.

A Guide to Life in Storm Damaged Trees, produced by Kathy Decker, is a laminated tri-fold leaflet that was designed to be taken into the woods to help identify some of the more common and not so obvious insects, diseases and vertebrates associated with forest stands that have undergone some sort of disturbance.

We have a few more copies of the *Guide to Common Bark Beetle (Coleoptera: Scolytidae) Endemic to the Northeastern United States*, by Jessica Rykken and Trish Hanson. Contact us for more information about any of these publications.

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COMMON PESTS OF CHRISTMAS TREES IN VERMONT 2000
REPORTED BY THE
DEPARTMENT OF FORESTS, PARKS AND RECREATION

INTRODUCTION

Information in this report is based largely on a systematic annual survey of Christmas trees in northern Vermont as part of the Scleroderris quarantine. This year 138 acres were surveyed in northern Vermont compared to 260 acres in 1999. Observations by Forestry Division personnel throughout the state are also incorporated. Acreage trend information reported refers to changes in surveyed plantations in northern Vermont and is not statewide totals.

INSECTS

Balsam Gall Midge populations remained at elevated levels this year, and damage did not drop as much as expected. Of the balsam fir Christmas trees visited in the northern Vermont survey, 49 acres received moderate damage, and 49 acres received light damage. Damage was more widespread than in 1999, and cool spring conditions prolonged the egg-laying period in many locations. A lot of heavy damage was reported(the most ever) and observed for plantations that were not a part of the annual survey, including many that had never had a gall midge damage problem in the past. Damage to wild trees was the heaviest ever seen. Damage should be much lighter in 2001. Galls examined from several different plantations in late September revealed that the good midge that controls the gall-maker was the most abundant midge present.

Balsam Shootboring Sawfly damage was much more common than in 1999 but at mostly light levels for the area surveyed. Numbers of adults emerging in monitored plantations was greater than for the peak year of 1998, but cold wet weather appeared to depress egg laying. Fewer adults were caught on 3 x 5 yellow sticky cards placed in mid-crowns of trees in Lamoille County than in 1998, averaging 16.6 per card compared to 1.1 per card in 1999, and 64 per card in 1998 for the same two locations. Adults again emerged during the last week of April and the first week of May when weather was warm. Weather after emergence turned cold and wet. This slowed Fraser fir bud development so that damage to balsam fir and Fraser fir was about equal this year (compared to heavier damage to Fraser in many years).

More evidence that the majority of these sawflies have a two-year life cycle was obtained this year. Emergence traps placed over small circular areas on the ground that had been seeded with larvae in 1998 captured 9 adults this year compared to 2 adults from these same areas in 1999.

Since damage is heaviest in even years and only light damage occurred in 1999 and 2000, growers should not experience any significant damage from this insect in 2001.

Balsam Twig Aphid populations decreased with mostly scattered, light damage throughout the state. All of the northern balsam fir Christmas tree plantations surveyed this year had only light damage.

Cooley Spruce Gall Adelgid damage to blue spruce and Douglas-fir increased, with 15 acres of light damage and 64 acres of moderate damage.

Eastern Spruce Gall Adelgid damage to white spruce remained common, at mostly light levels. The northern plantation survey found 12 acres of light damage and 22 acres of moderate damage.

Pine Leaf Adelgid damage to white pine remained low this year. Light populations of crawlers were observed on 24 acres of surveyed plantations in northern Vermont.

Pine Needle Midge damage to Scots pine increased from last year, with 22 acres of light damage and 10 acres of heavy damage detected, compared to no damage in 1999.

Introduced Pine Sawfly injury to white and Scots pine was light and scattered this year.

A Pine Fascicle Mite was observed lightly damaging 16 acres of white pine in northern Vermont.

Pine Shoot Moth damage to Scots and white pine leaders decreased this year. Light damage was detected on 22 acres.

Pine Spittlebugs were not observed during the northern survey this year, following widespread light populations in 1999.

Root Aphids were associated with chlorosis and browning of young Fraser firs in Springfield.

Spruce Spider Mite populations decreased this year despite strong overwintering egg numbers and the presence of mites early in the season in some plantations. Heavy rains and cool weather probably reduced mite numbers. Some plantations had large numbers of **Oribated** mites by late fall. These are tiny beetle-like mites that are scavengers known to feed on fungi. The wet summer probably increased the amount of food present for these non-harmful mites.

White Pine Weevil damage to pine and spruce trees remained common throughout the survey area, with 42 acres of damage and 40 acres of moderate damage in the northern Vermont survey, mostly on white pine. Heavy damage was reported for white spruce in one southern Vermont plantation.

Damage from the following insects was not observed during the northern Vermont Christmas tree survey this year: *Cinera Aphids, Pales weevil, Pine Spittlebug, Pine Thrips, Sawyer Beetle* and *Spruce Bud Moth.*

DISEASES

Cyclaneusma Needlecast of Scots pine remains very common. Light infection was detected within 59 acres of Christmas trees.

Delphinella Tip Blight decreased from last year. Only light infection of balsam fir was observed, for two plantations, totaling 20 acres.

Diplodia (Sphaeropsis) Tip Blight, was again commonly detected in Christmas trees this year, but damage was mostly light. A total of 86 acres were detected with light infection from this disease, while another 12 acres had moderate infection. Most damage was to fir, but pine was equally affected in mixed plantations containing fir and pine.

Fir-Fern Rust infection remained light this year. It was detected at light levels in 107 acres of fir plantations. The only exception was one plantation where moderate infection levels were observed in a localized low area with abundant sensitive ferns.

Lirula Needlecast was reported for one plantation in Wolcott where balsam fir had light infection, and Fraser fir had a trace of infection.

Lophodermium needlecast of Scots pine was observed in only one northern Vermont plantation, in Bakersfield.

Rhabdocline of Douglas fir was observed in one plantation in Bakersfield, at moderate infection levels.

Rhizosphaera Needle Blight of Fir, caused by *Rhizosphaera pini*, decreased this year. Light infection was reported for plantations in Bakersfield and Danville, while moderate infection was reported for plantations in Reading and Wolcott. Cutting of infected trees, coupled with basal pruning, has reduced infection levels in some plantations that had heavy damage.

Rhizosphaera Needlecast of spruce remains common, with 74 acres of light damage reported. Most infection occurred on lower branches and was related to crowding of trees.

Scleroderris Canker has not been found in any new towns since 1986. Eleven Christmas tree plantations within the quarantine zone were inspected this year and found free of the disease.

Sirococcus Shoot Blight of spruce was observed in one plantation in Waterville, at light levels.

Spruce Cushion Rust was reported for blue spruce in Springfield.

Swiss Needlecast of Douglas-fir remained common at moderate levels in plantations in Brookfield and Bakersfield, and was also reported for a plantation in Wells.

White Pine Blister Rust damage remains common throughout the survey area. Light infection was reported for 74 acres and moderate infection was reported for 23 acres in northern Vermont. Scattered mortality was also reported for a plantation in Wells. Some culling of infected trees has occurred in plantations previously reported to have heavy damage.

White Pine Needle Blight infection remains common for plantations where it has been reported in the past. Light infection was reported for 32 acres and moderate infection for 39 acres, comprising 7 plantations in northern Vermont.

Woodgate Gall Rust damage to Scots pine is slowly decreasing due to the thinning of infected plantations. Light damage was reported for 5 plantations, comprising 59 acres.

Yellow Witches Broom Rust of balsam fir remains common at mostly light levels. Moderate infection was reported for only one 10-acre plantation. Another 53 acres had light infection.

Frost Damage to balsam fir and white spruce occurred on most plantations surveyed in northern Vermont this year, but only light damage was observed.

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We thank Matt Mancini, Christmas Tree Pest Surveyor, for his keen observations and detailed reports that form the basis for much of this information.

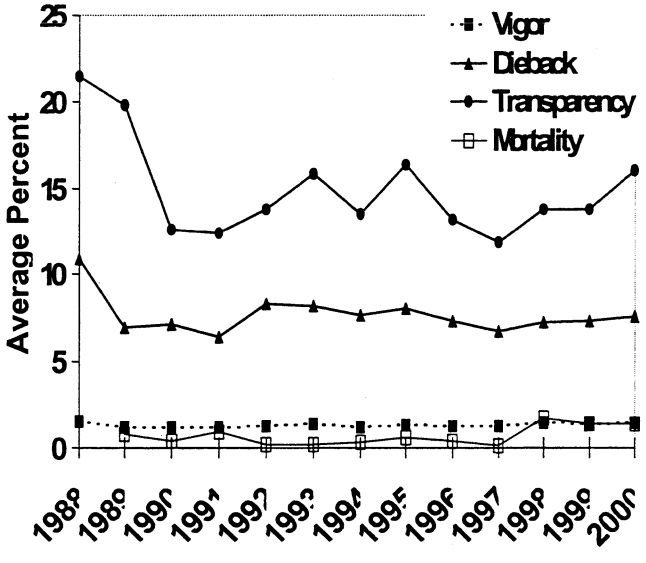
HEALTH OF SUGAR MAPLE IN VERMONT - 2000

Reported by the State of Vermont Department of Forests, Parks, and Recreation

This information on health of sugar maple is based on aerial surveys and field observations by the VT Dept of Forests, Parks, and Recreation, the University of Vermont and the U.S. Forest Service. Every year, the Department of Forests, Parks, and Recreation looks at tree health from the ground and from the air. In 2000, all 4.7 million acres of forestland were evaluated from an airplane at least once. In addition, survey crews walked to monitoring plots on the ground to rate tree condition. The fourth statewide survey of Hardwood Tree Health, which is re-evaluated every five years, was begun this summer. Aerial photographs were obtained for about 120 survey sites.

To assess their **General Condition**, 2000 sugar maples were evaluated for the North American Maple Project. Their health remained similar to previous years, with 93% of the trees rated as healthy. Mortality remains at 1.4% with some trees dying from the 1998 ice storm, and others affected by the 1999 drought.

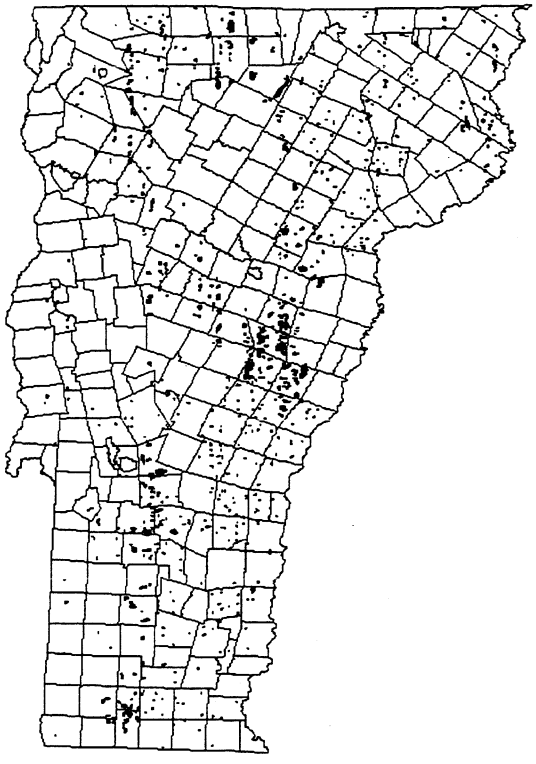
Condition of Sugar Maples in Vermont's North American Maple Project Plots



Browning of Sugar Maple Leaves occurred in scattered locations statewide, due to a complex of causes. Damage became visible in mid-summer. In all, 73,500 acres of brown foliage were mapped during aerial surveys.

Browning of Sugar Maples and Other Hardwoods in 2000

Wet spring conditions led to the buildup of fungus



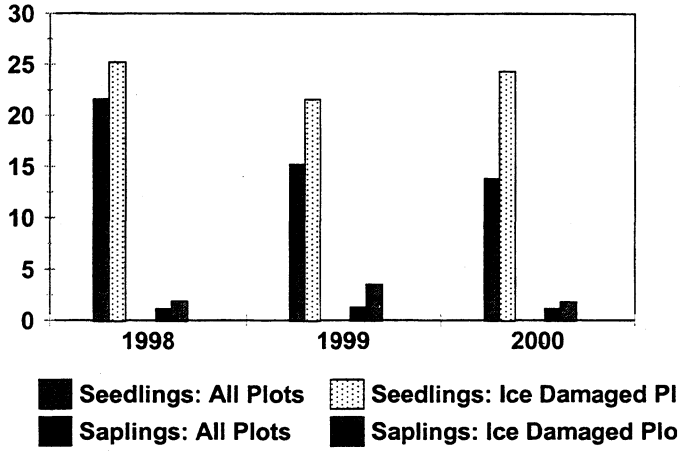
diseases like Anthracnose Leaf Blotch, and Phyllosticta Leaf Spot. An outbreak of Maple Leaf Cutter continued, causing heavy damage in some stands. The small, red-headed moths were commonly seen laying eggs on foliage in the spring. Heavy seed production, often associated with thin foliage, was also widespread, and was recorded on one-quarter of North American Maple Project monitoring plots. The leaf-rolling caterpillar, Maple Trumpet Skeletonizer, also contributed to browning in some sugarbushes.

Because heavy leaf browning did not occur until mid- or late summer, no severe impact on tree health is expected.

Sugar maples continued to recover from the **Ice Storm of 1998**. The condition of overstory trees improved as foliage filled in on broken branches and "epicormic" shoots. On ice-damaged monitoring plots, where 86% of the trees were rated healthy in 1999, 90% were healthy in 2000.

Sugar maple regeneration has increased in ice-damaged stands as seedlings and saplings respond to the increased light.

Number of Sugar Maple Seedlings and Saplings in Ice-Damaged Plots Compared to All North American Maple Project Plots

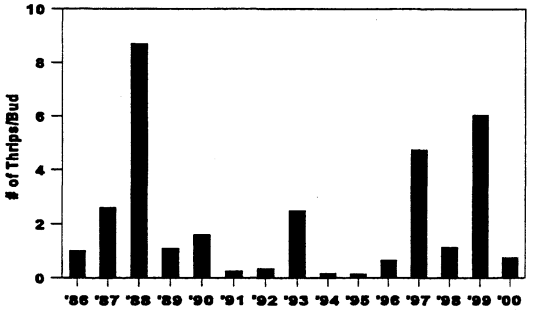


Researchers at the Cornell University Uihlein Field Station have examined the impact of ice damage on sap volume and sweetness between 1998 and 2000. Trees with the over one-quarter of their branches broken produced less sap than lightly damaged trees. Those with the heaviest damage (51-75% of the branches broken) increased more than others in sap volume in 2000, suggesting that recovery is occurring. No differences in sap sweetness between damage classes were significant.

The impact of the **Dry Conditions in 1999** was observed on some trees. Dieback or browning of leaf margins were particularly common on trees growing on rocky sites, trees disturbed by roads or construction, and trees with trunk wounds. Drought impacts are expected to continue for another couple of years.

Populations of **Pear Thrips** were low in spring of 2000. Very little damage was observed on sugar maple foliage, although some evidence of heavy egg-laying activity was observed on seed stalks. Because thrips produce more eggs when pollen is abundant, populations are expected to increase.

Thrips Numbers in Sugar Maple Buds



Asian Longhorned Beetle has spread to new locations in Manhattan and Chicago. Sugar maple is a favored host species. This insect has not been found in New England. However, look out for round holes (about 1/2" in diameter) on trunks and branches, and for coarse, excelsior-like sawdust.

Researchers continue to search for a chemical attractant to use in detecting this insect, but results to date have not been encouraging. Investigations into insecticide controls are also underway.

For More Information: Insect and disease reports, and requests for identification, publications, and information on control, should be directed to the County Forester or Forest Resource Protection personnel at our district or county offices.

Addison	388-4969	879-6565
Bennington	375-1217	483-2314
Caledonia	751-0111	751-0110
Chittenden	879-5694	879-6565
Essex	751-0111	751-0110
Franklin	524-6501	879-6565
Grand Isle	524-6501	879-6565
Lamoille	888-5733	476-0170
Orange	476-0173	476-0170
Orleans	334-7325	751-0110
Rutland	483-2730	483-2314
Washington	476-0172	476-0170
Windham	257-7967	885-8855
Windsor	296-7630	885-8855

Evaluating Crown Canopy Changes In Vermont Ice-Damaged Forests by Image Analysis

Methods

In 1999, photo points (20 per site) for stand level changes were established in two light to moderately damaged VMC plots in Ranch Valley (Mt. Mansfield), one heavily damaged site in Roxbury, one severely damaged site in Strafford and one severely damaged salvaged site in Orange. Three control plots were established - one in a very lightly damaged site in Ranch Valley, one in a very lightly damaged site in Strafford and one in a lightly damaged site in Orange. Vertical images obtained during July to August were analyzed for percent canopy cover using computer image analysis software(MultiSpec). New images taken from the same points in 2000 and in future years will be used to follow changes in canopy cover and crown condition.

An additional 72 photo points were established for oblique photography of individual tree crowns in various crown loss categories. This was completed for 44 sugar maple, 6 white ash, 15 yellow birch, 3 beech, and 2 paper birch trees, plus one black cherry tree. These will be used to illustrate crown recovery or demise and relate this to degree of crown loss due to the ice storm. Some of these images could probably be analyzed for silhouette leaf area so that changes in leaf area over time could be documented.

1999 Results

Percent canopy cover for ice-damaged stands ranged from 51 to 85 percent and averaged 69 percent. Percent canopy cover for control stands ranged from 79 to 86 percent and averaged 83 percent.

2000 Results

All stands except those at high elevations (Mt. Mansfield plots at 2200 ft.) had a significant increase in crown canopy cover in 2000 compared to 1999 (Figures 1 and 2). The Roxbury site had the largest increase, at 19%. The fact that this site was not as severely opened up as the Podunk and Butterfield sites, may account for the differences. The Butterfield stand had a salvage thinning in 1998, which further reduced the canopy cover and disturbed the site. Since even the lightly damaged control plots had an increase in canopy cover, the difference in available moisture between 1999 and 2000 is probably an important factor. Crowns of individual trees used for oblique photography also improved in both crown density and foliage color. Some showed dramatic improvement, with increases in crown density up to 80% over 1999 levels. Three of the trees died in the past year: 1 yellow birch with 95% crown loss, 1 sugar maple with 90% crown loss and 1 paper birch with 30% crown loss. Other trees with as much as 95% crown loss remained alive and showed some increase in crown leaf area as well as improved foliage color

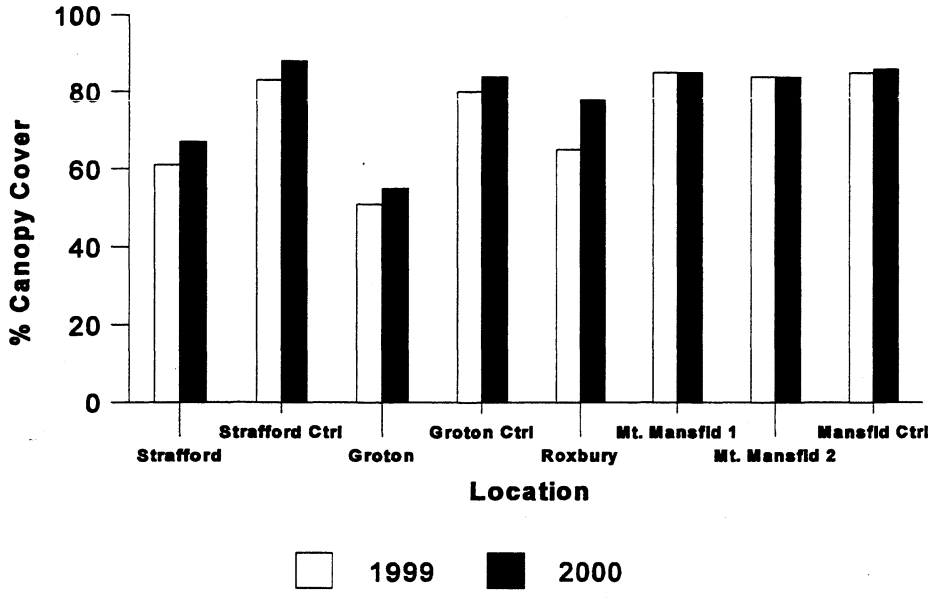
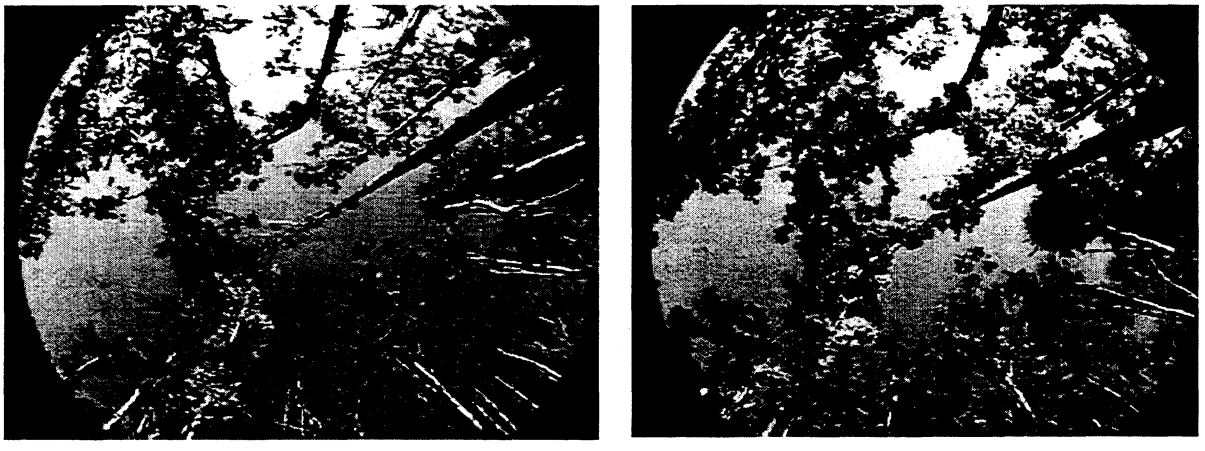


Figure 1.
Percent
canopy cover in 2000 compared to 1999.



1999 **2000**

Figure 2. Crown canopy images from one point in Strafford, illustrating the kind of improvement seen in some of the more heavily damaged sites.

R. S. Kelley 01/29/01

MOTHS CAUGHT IN LUMINOC LIGHT TRAPS IN HYDE PARK—2000

Moths listed below were collected from a Luminoc light trap that was deployed no a periodic basis in Hyde Park, Lamoille County, June 29 - September 20, 2000. Ron Kelley collected the moths and Mary Burnham sorted and identified the trap contents.

Collection Date Thursday, June 29, 2000

Family	**Species (Author)**	**Number**
Arctiidae	*Spilosoma virginica* (F., 1798).	3
Geometridae	*Cepphis armataria* (H.-S., 1855).	8
	Euchlaena serrata (Drury, 1770).	1
	Euphyia unangulata intermediata (Gn., 1857).	1
	Probole amicaria (H.-S., 1855).	1
Noctuidae	*Acronicta innotata* Gn., 1852.	1
	Acronicta superans Gn., 1852.	1
Notodontidae	*Nadata gibbosa* (J. E. Smith, 1797).	1
Pyralidae	*Phlyctaenia coronata* (Hufn., 1767).	4
Saturniidae	*Actias luna* (L., 1758).	1
	Antheraea polyphemus (Cram., 1776).	10
Sphingidae	*Paonias excaecatus* (J. E. Smith, 1797).	4
	Paonias myops (J. E. Smith, 1797).	

Collection Date Wednesday, July 05, 2000

Family	Species (Author)	Number
Arctiidae	*Spilosoma virginica* (F., 1798).	5
Geometridae	*Cepphis armataria* (H.-S., 1855).	1
	Epirrhoe alternata (MŸller, 1764).	1
	Euchlaena tigrinaria (Gn., 1857).	10
	Xanthotype urticaria Swett, 1918.	3
Noctuidae	*Lithacodia synochitis* (G. & R., 1868).	1
Notodontidae	*Nadata gibbosa* (J. E. Smith, 1797).	3
Pyralidae	*Anageshna primordialis* (Dyar, 1907).	5
	Phlyctaenia coronata (Hufn., 1767).	13
Saturniidae	*Actias luna* (L., 1758).	1
	Antheraea polyphemus (Cram, 1776).	6
Sphingidae	*Paonias excaecatus* (J. E. Smith, 1797).	1
	Paonias myops (J. E. Smith, 1797).	2

Collection Date Wednesday, July 12, 2000

Family	Species (Author)	Number
Arctidae	*Spilosoma virginica* (F., 1798).	2
Geometridae	*Bliston betularia* (L., 1758).	1
	Euchlaena tigrinaria (Gn., 1857).	1
	Hydria prunivorata (Fgn., 1955).	1
	Xanthotype urticaria Swett, 1918.	3
Noctuidae	*Polia nimbosa* Gn., 1852.	1
Pyralidae	*Anageshna primordialis* (Dyar, 1907).	5
Sphingidae	*Paonias excaecatus* (J. E. Smith, 1797).	

Collection Date Monday, July 17, 2000

Family	Species (Author)	Number
Geometridae	*Hydria prunivorata* (Fgn., 1955).	1
	Sicya macularia (Harr., 1850).	1
	Xanthotype urticaria Swett, 1918.	1
Noctuidae	*Parallelia bistriaris Hbn., 1818.*	1
	Polia nimbosa Gn., 1852.	4
	Zanclognatha ochreipennis (Grt., 1872).	2
Notodontidae	*Nadata gibbosa* (J. E. Smith, 1797).	2

Collection Date Thursday, July 20, 2000

Family	Species (Author)	Number
Arctiidae	*Hypoprepia fucosa* Hbn., 1827-1831.	1
Drepanidae	*Oreta rosea* (Wlk., 1855).	1
Geometridae	*Sicya macularia* (Harr., 1850).	1
Noctuidae	*Polia nimbosa* Gn., 1852.	4
Sphingidae	*Paonias excaecatus* (J. E. Smith, 1797).	1

Collection Date Tuesday, July 25, 2000

Family	Species (Author)	Number
Arctiidae	*Hypoprepia fucosa* Hbn., 1827-1831.	6
Geometridae	*Biston betularia* (L., 1758).	1
	Caripeta divisata Wlk., 1863.	1
	Hydria prunivorata (Fgn., 1955).	2
	Itame pustularia (Gn., 1857).	2
	Nematocampa limbata (Haw., 1809).	1
	Xanthotype urticaria Swett, 1918.	1
Noctuidae	*Metalectra quadrisignata* (Wlk., 1858).	2
	Polia nimbosa Gn., 1852.	18
	Zanclognatha orchreipennis (Grt., 1872).	6
Notodontidae	*Nadata gibbosa* (J. E. Smith, 1797).	4
Saturniidae	*Antheraea polyphemus* (Cram., 1776).	4
Sphingidae	*Paonias excaecatus* (J. E. Smith, 1797).	3

Collection Date	Friday, July 28, 2000	
Family	**Species (Author)**	**Number**
Arctiidae	*Apantesis (=Grammia) virgo* (L., 1758).	1
	Hypoprepia fucosa Hbn., 1827-1831.	5
	Platarctia parthenos (Harr., 1850).	1
Geometridae	*Caripeta divisata* Wlk., 1863.	1
	Hydria prunivorata (Fgn., 1955).	1
	Nematocampa limbata (Haw., 1809).	5
Noctuidae	*Idia rotundalis* (Wlk., 1866).	8
	Polia nimbosa Gn., 1852.	14
	Zanclognatha ochreipennis (Grt., 1872).	3
Notodontidae	*Nadata gibbosa* (J. E. Smith, 1797).	1
Pyralidae	*Herpetogramma theseusalis* (Wlk., 1859).	1
Saturniidae	*Antheraea polyphemus* (Cram., 1776).	1
Sphingidae	*Paonias excaecatus* (J. E. Smith, 1797).	3

Collection Date	Monday, July 31, 2000	
Family	**Species (Author)**	**Number**
Arctiidae	*Halysidota tessellaris* (J. E. Smith, 1797).	1
	Hypoprepia fucosa Hbn., 1827-1831.	3
Geometridae	*Biston betularia* (L., 1758).	1
	Itame pustularia (Gn., 1857).	1
	Nematocampa limbata (Haw., 1809).	2
Noctuidae	*Idia rotundalis* (Wlk., 1866).	8
	Phlogophora periculosa Gn., 1852.	1
	Polia nimbosa Gn., 1852.	22
	Xestia bicarnea (Gn., 1852).	1
	Xestia normaniana (Grt., 1874).	1
Pyralidae	*Crambus girardellus* Clem., 1860.	1

Collection Date Thursday, August 03, 2000

Family	Species (Author)	Number
Arctiidae	*Halysiodota tessellarius* (J. E. Smith, 1797).	1
	Hypoprepia fucosa Hbn., 1827-1831.	10
Geometridae	*Eugonobapta nivosaria* (Gn., 1857).	1
	Nematocampa limbata (Haw., 1809).	6
Noctuidae	*Calyptra canadensis* (Bethune, 1865).	1
	Idia lubricalis (Gey., 1832).	2
	Parallelia bistriaris Hbn., 1818.	1
	Polia nimbosa Gn., 1852.	6
	Xestia normaniana (Grt., 1874).	2
	Zanclognatha orchreipennis (Grt., 1872).	5
Pyralidae	*Herpetogramma theseusalis* (Wlk., 1859).	1
Saturniidae	*Antheraea polyphemis* (Cram., 1776)	1

Collection Date Monday, August 07, 2000

Family	Species (Author)	Number
Arctiidae	*Halysidota tessellaris* (J. E. Smith, 1797).	2
	Hypoprepia fucosa Hbn., 1827-1831.	25
	Spilosoma virginica (F., 1798).	1
Drepanidae	*Drepana arcuata* Wlk., 1855.	1
Geometridae	*Itame pustularia* (Gn., 1857).	3
	Nematocampa limbata (Haw., 1809).	1
Noctuidae	*Diachrysia balluca* Gey., 1832.	1
	Parallelia bistriaris Hbn., 1818.	1
	Phlogophora periculosa Gn., 1852.	3
	Polia nimbosa Gn., 1852.	2
	Pseudaletia unipuncta Haw., 1809.	1
	Xestia normaniana (Grt., 1874).	27

Collection Date Wednesday, September 20, 2000

Family	Species (Author)	Number
Geometridae	*Nepytia canosaria* (Wlk., 1863).	2
Noctuidae	*Amphipyra pyramidoides* Gn., 1852.	2
	Autographa precationis (Gn., 1852).	1
	Macronoctua onusta Grt., 1874.	1
	Nephelodes minians Gn., 1852.	2
	Noctua pronuba (L.).	1